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The

Essex Naturalist:

BEING THE

JOURNAL

OF THE

ESSEX FIELD CLUB,

EDITED BY

WILLIAM COLE, F.L.S., F.E.S.,
Honorary Secretary and Curator.

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[*This Part contains the first Instalment* (*nine*) *of the Twenty-five Plates by Mr. C. Sillem, which will be used to illustrate the Monograph on the British Woodlice.*]

Insertion—A reprint of pp. 367-8 of Vol. XIII., with errors corrected, to be substituted in binding up the Volume.

The Authors alone are responsible for the statements and opinions contained in their respective papers.

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THE ESSEX FIELD CLUB.

Membership of the Club.—Information respecting Membership and the work of the Club, with forms of proposal, will be sent on application to the Hon. Secretaries, at the Head-quarters.

The Essex Museum of Natural History (*Romford Road, Stratford, Essex*) is designed and arranged as a Local Museum for the County, and as an Educational Museum for use of the general public, students and schools. Included in the scheme is a Lecture-room for Demonstrations and the aid of a growing Library of some of the most useful monographs of British Geology, Botany, and Zoology, *for the use of Students in the Museum*. *Curator*, W. COLE. *Assistant*, HENRY WHITEHEAD.

The Epping Forest Museum, established by permission of the Corporation of London in Queen Elizabeth's Hunting Lodge, Chingford, Essex, is devoted to the elucidation of the Natural History and Antiquities of Epping Forest, and as a centre for Nature-study for schools and young naturalists. *Honorary Curators*, W. COLE, B. G. COLE, and H. A. COLE.

The Libraries of the Club include works on Natural History, Geology, and Antiquities, with a special department of books, pamphlets, and MSS. relating to Epping Forest. *Honorary Librarian*, THOMAS W. READER.

The Photographic and Pictorial Survey of Essex has been founded for the preservation of photographs, pictures and maps, etc., illustrative of the topography, antiquities, social habits, natural history, etc., of the County. The collections will be stored in the Essex Museum, and will be available for reference on application to the Curator. *Hon. Secretary*, VICTOR TAYLOR, Hurstleigh, Buckhurst Hill, Essex.

THE

ESSEX NATURALIST:

BEING THE

Journal of the Essex Field Club

FOR 1905-1906.

(VOLUME XIV.)

ON NATURAL HISTORY MUSEUMS.

An Address delivered to the Essex Field Club at the Annual Meeting, April 8th, 1905,

By F. W. RUDLER, I.S.O., F.G.S., *President.*

THE members of the Essex Field Club have met together on this occasion under circumstances of an exceptionally interesting character. As pointed out in the notice convening this meeting, the Club has now completed the twenty-fifth year of its history. Not only has it gone on for a quarter of a century regularly holding its evening meetings and its field meetings, but during this long period it has enjoyed the advantage of retaining uninterruptedly the services of its Honorary Secretary and Founder, Mr. William Cole. Moreover, for nearly the whole of this long term he has been associated in the Secretarial work with Mr Benjamin G. Cole. This exemplary devotion of two brothers to the service of our Club—not to mention the valued assistance of Mr. Henry A. Cole and of the ladies of the family—seems to me deserving of some recognition, more substantial in character than the verbal thanks formally voted at an Annual Meeting. But Mr. W. Cole, having the interest of the Club ever at heart, assured us some time ago that the recognition of the twenty-fifth Anniversary which would best please him would be the means of completing the Epping Forest Museum. Just as the Club itself originated with Mr. W. Cole, so this museum owes to him its initiation; and it is consequently but natural that he should desire to see his ideas brought to maturity. Whatever, therefore, may be done on some future occasion, our immediate attention should be given to this modest suggestion with regard to the Forest Museum; and I think I cannot do

better than seize the opportunity afforded by the Annual Meeting to plead very urgently on behalf of this part of the work of our Club.

It should be our proud endeavour to make the little Museum in the old Hunting Lodge an attractive centre of scientific instruction to the multitudes who visit the Forest every season. To do this is by no means an easy matter. It requires much knowledge and great skill, a good deal of labour, and a little money. If the Club undertakes to furnish gratuitously the knowledge, the skill and the labour, surely it is not unreasonable to expect the money to be forthcoming from some other source. As a matter of fact, however, the members of our Club have done much themselves in furnishing funds, but their donations, though generous, are still insufficient for the work at present contemplated. According to a recent estimate the sum of £200 is now required to bring the arrangement of the Museum within a reasonable approach to completeness. With this moderate sum, it is believed that it would be possible to procure such glass-cases and specimens as are urgently needed to make the museum representative of the Natural History of the Forest District. It seems absurd that a work of this importance should be delayed through any difficulty in raising so comparatively trifling a sum!

The Museum at Chingford may be regarded as a Monograph of the Natural History of the Forest, illustrated with realities and not semblances—a monograph which may be read by every visitor more readily, yet more profitably, than any illustrated book. Instead of turning over the pages of a volume and admiring the plates, the visitor passes from case to case, seeing in most instances the veritable objects instead of their mere presentment on paper, and learning about these objects many a useful lesson from the descriptive labels, with which they are invariably accompanied. In a "Museum Leaflet," issued by our Club ten years ago, Mr. W. Cole explained the purpose of the Museum to be two-fold; first, to "promote a love for the out-of-door study of Natural History, etc., among the intelligent visitors to the Forest," and secondly, "to form a store-house for the preservation of authentic series of forest-specimens."[1] Both these objects have been already, to a great extent, fulfilled—

(1.) *A short account of the Epping Forest Museum. E.F.C. Museum Leaflets, No. 1.* 1895.

fulfilled, indeed, so far and in such way as our means have permitted.

As many of our members may not have visited the Forest Museum recently, it may not be without use to explain what has already been done there, and what more it is intended to do, provided the necessary funds are forthcoming. Even in its present incomplete state the Museum is a source of much attraction to the crowds of excursionists in the summer months. It appeals to many who might not otherwise be attracted to a Museum. A visitor to the forest will casually enter the Lodge, and have his attention arrested by the collections, whereas he might never think of making a definite visit to a Museum in town. And who dares to guess what far-reaching results may perchance flow from such an accidental introduction! It may be true as Oliver Wendell Holmes said, that the ordinary visitor to the British Museum "will know as much about it as the fly that buzzes in at one window and out at another." But that, I believe, is due mainly to the bewildering wealth of our National Treasure-house. A small museum is likely to have in some respects much more educational value than a large one; and just because our Forest Museum is not embarrassingly rich in specimens, I venture to assess its value as altogether out of proportion to its magnitude. That remarkable man, the late Professor Rolleston, remarked that "a young man who is possessed of a talent for Natural Science and Physical Inquiry generally, may have the knowledge of this predisposition made known to himself and to others, for the first time, by his introduction to a well-arranged Local Museum."(2) Is it unreasonable to hope that some bright spirit—perhaps some 'potential Darwin'—may date his inspiration from a casual visit to that little Museum in the Forest?

Obviously the first thing that claims attention in a forest is its timber; and hence a Forest Museum must contain, first and foremost, illustrations of the *Forest Trees*. Of the throngs of Londoners who visit Epping Forest, how small a proportion could name the common trees, even when clad in all their livery of green! I heard of a Cockney who, failing to distinguish one tree from another, grouped the oak, the beech, the elm, and a

(2) Address to the Biological Section of the British Association at Liverpool, 1870. *Report*, p. 93.

number of others together under the vague name of "the *ordinary* tree."[3] It is not contended for a moment that a man will be a better citizen because he calls an oak *Quercus*, and a beech *Fagus*; but it is undoubtedly true that the man who marks the essential points of difference between one tree and another—who can distinguish, say, the hornbeam from the beech or the elm—is a man who exercises his faculties of observation, and to that extent is likely to become a better workman and a more intelligent member of Society.

Ignorance of the forest trees may readily be overcome by a little study of the specimens, which are already shewn in the museum, mounted in glass-cases affixed to the wall on the great staircase and on the landings. Here the visitor finds preserved specimens of the foliage and the fruit, with sections of the wood, and photographs of the trees shewing their characteristic habit; whilst in some cases, the diseases of the trees have been illustrated by Mr. Paulson.

The *Herbaceous Flowering Plants* of the forest are illustrated during the season by specimens of cut flowers, duly labelled—a source of never-failing interest to the procession of young people who pass through the rooms at holiday time. The frequent change of fresh flowers involves, however, much work; and it seems to me desirable that some of our members living near the Museum should offer to assist the Curator in this respect. Botany is a subject much cultivated by many ladies, and it would surely be an interesting occupation for ladies of leisure to collect the plants and label them, giving with the name a brief note which might include, if nothing else, scraps of folk-lore, such as may readily be found in popular works on wild flowers. Such information, neatly expressed, makes very pleasant reading, and would render the plants attractive even to those who have no aspiration to become botanists. "Of the many thousands who visit us on every sunny day in summer," says Mr. E. N. Buxton, "few return without securing some floral trophy, which it has given them infinite pleasure to gather."[4] Would it not be well that they should carry off with their trophy some interesting scraps of information, which will abide long after the flowers themselves shall have perished!

(3) *Landscape Geology*. By Hugh Miller, 1891. p. 38.
(4) *Epping Forest*. By Edward North Buxton, Verderer. London, 1885., p. 114.

Dried plants are not readily exhibited, and if exhibited are not generally attractive, It is true they may be mounted in frames and glazed, but they require much space for their display upon the wall. A preferable mode is to hinge the glazed frames to an upright standard, so that they be made partially to revolve. The proper course, however, is to preserve the specimens in an herbarium, and to consult them as books may be consulted in a library.

Fortunately our Club possesses a good collection of dried plants, preserved in eight cabinets, now in the Stratford Museum. This herbarium includes the important donation of specimens due some years ago to the generosity of Mr. J. C. Shenstone ; it contains also the late Mr. Sewell's collection, presented by his widow; Mr. E. J. Powell's herbarium, and Dr. Varenne's collection of Cryptogams. I understand from Mr. W. Cole that he is about to arrange these herbaria in two series—the one a general collection of British plants for the use of the student; the other limited absolutely to the Flora of Essex.[5] Our local herbarium will be invaluable to future botanists, inasmuch as we possess representatives of plants from numerous localities in Essex now built over or otherwise lost to science.

A large number of our Essex specimens have been obtained from the Forest district, but it hardly seems desirable to remove these to the Forest Museum, inasmuch as there they could scarcely be exhibited to advantage. Although an herbarium is clearly of the highest value to the student of systematic botany, it is hardly a suitable object for public exhibition. Indeed Prof. Weiss, of Manchester—a very high authority—has said "I regard the Herbarium as not forming part of a Museum."[6] Probably the ordinary visitor would find good coloured plates of the flowers of the Forest more serviceable than dried specimens; for these have generally lost to a large extent their colour and even their shape, so that the tyro would be more likely to identify his specimen from a well-executed coloured plate than from the dried plant.

It is said, I believe, that among English counties Essex stands second only to Herefordshire in the interest of its *Fungi*.

(5) On the arrangement of dried plants see a paper by Mr. E. M. Holmes, F.L.S., on "The Arrangement of Herbaria." *Report of Museums Association*, Sheffield, 1899, p. 63.

(6) "The Organization of a Botanical Museum." By F. E. Weiss. *Rep. Mus. Assoc.*, Manchester, 1892, p. 25.

Our Club indeed has became rather famous for its annual Fungus Forays in the Forest. Some of the common fungi of Epping Forest are so conspicuous as to attract general attention, and it should always be the object of our Museum to enable a student—or even a chance visitor—to identify any natural object which he may find in the course of a Forest ramble. In the Museum at Chingford there is a good collection of preserved specimens of the local fungi, accompanied by coloured drawings, and well displayed in a series of wall-cases. Some of the specimens, I believe, were prepared by that skilful naturalist, the late Mr. English, of Epping. Nor should we omit to notice the set of original drawings of flowerless plants, executed specially for the Museum by our veteran friend, Dr. M. C. Cooke. This series of large drawings, framed and glazed, is mounted on screens in the Upper Room of the Museum, where it offers in an attractive form much information to the visitor.

So far as the zoology of Epping Forest is concerned, popular interest seems to centre in the *Insects*—if, at least, we may judge from the large number of visitors who carry butterfly-nets and other entomological gear. The Curator, whom we all know to be an enthusiastic entomologist himself, has done well to minister to their tastes by a remarkably fine display in the Oak Room Here the instructive specimens illustrating the life-history of the Forest butterflies and moths, with their food-plants, is especially noteworthy. As most insects suffer deterioration by the action of light, they are here preserved in flat glass-cases, which are provided with covers that may be freely opened by the public, whilst the covers themselves are glazed and serve for the display of a most attractive series of coloured plates of insects, taken, I believe, from Curtis's *Entomology*, The effect of this admirable method of utilizing the covers of the cases contrasts very favourably with the ordinary practice of screening the specimens from light by means of moveable covers of American cloth, or other opaque material—a method which is rather unsightly and decidedly uninstructive.

With regard to the *Mollusca*, reference should be made to the fine collection of land and fresh-water shells from the woods and lanes, the ponds and streams, of the Forest District, which has been on loan for many years by the courtesy of Mr. Walter Crouch, by whom they were collected and to whom the Museum

has so often been in other ways greatly indebted. The educational value of this collection is much increased by Mr. Crouch's neat drawings of the living molluscs, shewing their relation to the shells. I understand that a large collection of Forest species is in course of preparation, and as this is the property of the Club it will be a permanent exhibit. It is well to note, too, that some of the living mollusca will be on view in the aquaria in the museum, and I feel sure these will prove a constant source of interest and instruction to the visitors. The fascination of living things makes an aquarium one of the most popular features in any Museum, and amply repays the trouble which it necessarily involves.

It is not so easy to represent the *Vertebrata* of the Forest in our small Museum as it is to illustrate the invertebrate fauna. There is, however, in the Banqueting Hall a collection of *Birds' Eggs* (founded on a collection presented by Mr. G. E. Vaughan), in glass-topped boxes; and as many eggs suffer by direct exposure to light, they are protected, like the insects, by covers to the table-cases in which they are preserved. These glazed covers are utilized by the display of a charming series of coloured plates and reproductions of photographs, illustrating the residents, migrants and visitors to the forest, with their nests. The effect of thus appropriating what would otherwise be bare covers is admirable; but let it not be forgotten that the judicious selection, the neat mounting, and the careful labelling of such a series of plates, must have required the expenditure of much time and thought. It is evident that some sympathetic hand must have been busy with this work, and I think I trace that of Mr. Henry Cole.

At present there is no collection of stuffed birds in the Museum, but it is proposed, as soon as sufficient funds are in hand, to place in the centre of the Banqueting Room a pedestal case, divided into four compartments, each containing a small collection of the *Birds* of the Forest, in association with their natural surroundings. What species are to be represented I know not; perhaps it is not yet decided. But in view of the great interest of the Heronry in Wanstead Park, I should think that a group of herons, with the nest, would be at once appropriate, attractive and instructive. Fortunately the Club has, in its new president, a distinguished ornithologist, under

whose guidance we may be sure that the birds will receive due attention. It is also intended, our purse permitting, to erect a case in the middle of the Oak Room, on the lower floor, with a collection of the small *Mammals* of the Forest, showing their natural environment. At present the Forest mammals are represented only by a few examples of heads and antlers of the fallow deer, the red deer, and the roe deer—with one stuffed specimen of the forest breed of fallow deer.

In the picturesque mounting of natural objects, we cannot hope to imitate the splendid groups in the British Museum (Natural History), or even to vie with those of the large Provincial Museums, such as the fine pictorial groups by Mr. Montagu Browne, at Leicester. But even in a small way, we may be able to invest our stuffed birds and mammals with a touch of living interest. Instead of mounting them in the time-honoured fashion on polished pedestals of wood, we may at least encircle them with something suggestive of their forest-surroundings. The realistic adjuncts of a "habitat group" appeal especially to the young visitor; and a young visitor is always worth attracting.

Although the pictorial mounting of natural history objects has been brought promimently forward in recent years, it is by no means a new thing in Museums. In the early years of the last century, there existed at the Egyptian Hall, in Piccadilly, in connection with Bullock's famous Museum, an exhibition called the *Pantherion*. The conception was much too ambitious, since it aimed at representing, as far as possible, the whole of the mammalia, but its merit and novelty lay in the attempt to convey, in the words of its projector, "a more perfect idea of their haunts and mode of life than has hitherto been done."[7]

By means of a tropical scene, with models of appropriate vegetation, such creatures as the lion, the elephant, the rhinoceros, and the giraffe were "exhibited as ranging in their native wilds and forest." With regard to our unambitious Museum at Chingford, it seems in the highest degree desirable that we should be able to set up without further delay a few groups of local birds and mammals, under conditions suggestive of a glimpse of wild nature in Epping Forest. Nature-study is making us now-a-days

(7) *A Companion to the London Museum and Pantherion.* By William Bullock, London. 1816 (17th Ed.) p. 97.

rather impatient of artificiality, and indeed the naturalistic idea is even being extended from the Museum to the Menagerie. Just as people are not satisfied to-day with seeing in our glass cases stuffed birds perched in rows on monotonous stands of turned wood, so they are getting rather tired of seeing wild animals pent up in rows of cages; and Mr. Hagenback is said to have in view a scheme which will enable him in the near future to exhibit the animals under conditions apparently approaching to some extent those of nature.

At the present time there is displayed in the Upper Room of the Forest Museum a small collection of *Fossil Vertebrata*, representing the ancient fauna of the district; but the question is under consideration, whether it would not be expedient to remove these objects to Stratford, and devote the space at Chingford, which is but very limited, to illustrations of the fauna and flora of the Forest as they exist to-day.

Whilst the Chingford Museum makes natural history its most prominent feature, it has always sought—and quite legitimately—to illustrate the early archæology of the district, especially the *Prehistoric ages*. Hence we find in the Banqueting Hall the interesting collection of relics which were dug up from the two Forest camps—the camp at Amesbury Banks explored by our Club in 1881, and Loughton, or Cowper's Camp, examined in the following year, both probably of British origin. Then again the same room contains the valuable group of antiquities obtained by Mr. Chalkley Gould in the course of his exploration of the Romano-British settlement at Chigwell, and so well described in his Museum Handbook.[8]

The mention of antiquarian relics raises a suggestion which, to some, may appear rather startling. Will the day ever come when it will be possible to divorce these relics from the natural history objects with which they are now associated, so that the works of art may be shewn in one building and the works of nature in another? It is true that Sir Thomas Browne, that grand old East Anglian worthy, quaintly says that "All things are artificial, for nature is the art of God." But taking words as common-place people like ourselves use them, there seems ample justification for separating, under certain conditions, the

(8) "Notes upon the Romano-British Settlement at Chigwell, Essex." By I. Chalkley Gould, Essex Field Club Museum Handbooks, No. 2, 187.

artificial from the natural, and recognizing two groups of objects appealing to two types of visitor, not always in sympathy with each other's tastes.

Now that the Forest Museum, after costing so much thought, labour and money, is approaching within moderate distance of completion—so far at least as is contemplated by our modest scheme—it seems rather ungracious, not to say ungrateful, to raise any doubt as to the fitness of the present building for the purposes of a Natural History Museum. And yet such a doubt can hardly be repressed by any unprejudiced visitor. No one will deny that the building is much too small, and that the illumination in parts is sadly defective. Even with the addition of the new glass cases suggested in our scheme, there will be provision for only a very inadequate representation of the fauna and flora of the Forest. Mr. E. N. Buxton has very wisely raised his voice against over-crowding the Rooms. No one but a naturalist has any notion of the prodigality of life in the Forest district, and even the naturalist has probably but very imperfect ideas on such a subject. It is related that a certain professor once projected the formation of a Museum to be confined to the natural objects collected in the Gardens of Lincoln's Inn; but after a while he found himself compelled to abandon his scheme in consequence of the great number and variety of objects which the locality yielded.[9] If Lincoln's Inn Fields are so rich, what must the Forest be? The district which we desire to illustrate in the Museum is indeed much too prolific to be adequately represented in our present restricted quarters.

Nor is the illumination everywhere sufficient, except on very bright days, to enable the visitor to inspect the specimens with satisfaction. It is true that many natural objects suffer from exposure to light, but the Curator can always shut out light, or moderate it, by means of blinds, whilst he can hardly ever admit more natural light than the architect has permitted. It is therefore, in my opinion, a matter of prime importance that every Museum should be so constructed as to allow a free flood of light into the exhibition galleries. Some people possibly may think otherwise, and prefer a dull and dreary place. One of the most curious remarks I ever met with in connection

(9) *Hints on the Formation of Local Museums.* By the Treasurer of the Wimbledon Museum Committee, London, 1863, p. 20.

with Museums was that of a writer who, otherwise uttering much common sense, held that "the drowsy appearance of a Museum peculiarly adapts it to the requirements of students."[10]

If I might be bold enough to throw out a hint as to what I should like to see in the Forest Museum of the future, I would venture to say that in my opinion the present building, with its interesting associations, should be used as a small antiquarian Museum and that the Natural History collections should be removed to a neighbouring building to be specially erected for their reception—a building which may be severely simple in architecture, but which shall be spacious and light.

The exhibits at present at Chingford may be regarded, for convenience, as falling into two groups—one scientific, the other archæological; though I do not for a moment intend to suggest by this conventional arrangement that archæology is not to be treated on scientific principles. The display of scientific objects in an ancient building always strikes me as rather incongruous, whereas objects of archæological interest readily harmonize with their antique surroundings. If I may dare to introduce just one word of criticism respecting another museum in Essex, I would refer to that at Colchester. There the archæological treasures, which everyone knows are of surpassing interest and inestimable value, including the famous Joslin and Jarmin collections, may not be considered altogether out of keeping with the venerable castle in which they are housed, but the small Natural History collection in the same building seems to me quite out of place in such an edifice.

Queen Elizabeth's Hunting Lodge, the present home of the Epping Forest Museum, is an example of early Tudor architecture, which itself forms a fine specimen for an "Open Air Museum." By the restoration of this building, the Corporation of the City of London has earned the gratitude of every lover of antiquity. It seems to me that the ideal way of utilising the old building would be to furnish it with appropriate objects of corresponding age, so that the whole might form a grand historical object-lesson. But as such an ideal is never likely to be reached, the next best thing is to use the building for the

(10) *Principles which should govern the classification and arrangement of Public Museums.* By Henrie O'Hara. Dublin: 1862, p. 3.

exhibition of a wider archæological collection of local character. The fittings should harmonize with the antique aspect of the rooms, and the contents of the cases should carry the visitor back, in imagination, to the distant past. All the antiquarian objects now on exhibition might remain in their present home—the relics from the Camps and the Chigwell Settlement, the stone and bronze implements, the old fire-producing appliances, the tapestries, the pictures, and the engravings of local interest. But all the natural history objects should, in my opinion, be transferred to new quarters—spacious, airy, and bright—where they would be more attractive and of greater educative value than in their present rather unsuitable location.

That the Forest Museum, even in its present state, is widely appreciated, let the thousands who throng it every season testify. But notwithstanding the crowds which pass through the rooms, a large proportion being children, scarce a single instance is known in which any damage has been wilfully done. This is the more remarkable, considering what a large surface of glass is exposed; moreover, there are many specimens under glass shades, accessible on shelves in the room, yet it is the rarest thing for these or the small glass vivaria to get injured.

To the schools which so often visit the Forest the museum is a source not only of great attraction, but in many cases of permanent profit. Children are quick to observe and ready to remember, full of curiosity and usually interested in a remarkable degree in living things, such as will be seen in the aquaria and vivaria in the museum, So again, to the young naturalist visiting the Forest, this museum is a feature of exceptional interest, for here he may hope to identify the spoils which he has secured in his rambles. Special attention should therefore be given to the exhibition of common things. The resorts of the London naturalist are unfortunately but few, and are getting fewer every year, but we rejoice that the Forest, which is one of the most favoured haunts, is preserved for ever from the defilement of bricks and mortar. May it have eventually a museum which shall be worthy of its reputation!

Five years after the Epping Forest Museum had been opened another Museum under the care of our Club, of wider scope than that at Chingford, inasmuch as it represents the whole county of Essex, was formally opened at Stratford by the Countess of

Warwick.[11] As the history of this Museum has been written by Mr. W. Cole in one of our little "Handbooks" I am relieved of the necessity of entering into historical details.[12] It is not without interest, however, on the occasion of this—our twenty-fifth—annual meeting, to recall the fact that the idea of forming a museum was entertained by those who founded the Club, and was distinctly explained by our first President, Prof. Meldola, in his inaugural address. There is probably no member of our Club ignorant of the way in which that idea, though long in abeyance, was ultimately carried out through the enlightened policy of the Corporation of West Ham, associated with the munificence of Mr. Passmore Edwards.

On entering the Passmore Edwards Museum, anyone familiar with the details of museum work will be struck with the admirable way in which modern ideas have been carried out. It is not a museum run on old lines, like many of those which are themselves qualified to be preserved in a larger museum as interesting, but rather melancholy, records of obsolete science. True it is but a small museum, yet it is arranged in harmony with the state of knowledge in the twentieth century. In a discussion on "The Museum Question" a few years ago in Liverpool, Prof. Herdman, one of our most distinguished naturalists, condemned the usual methods of exhibiting natural history objects as suggestive of the days of Linnæus, rather than of present day biology.[13] At Stratford, however, he would find, I venture to think, little or nothing of an antiquated character. Mr. Cole has taken care that the biological clock should not be put back to the time of Linnæus. Let the visitor turn to the left as he enters the building, and he finds himself at once in a recess surrounded by cases which contain beautiful illustrations of the leading *Principles of Bionomics*. Here are several well-chosen series of specimens, chiefly insects, illustrating such subjects as protective and aggressive resemblance for concealment by colour and form; protection by warning colours; mimicry, or imitation of protected animals; and dimorphism or differences relating to season and sex. In a yet more prominent position in the body of the hall is a wall-case devoted to specimens,

11 ESSEX NATURALIST, Vol. xi. (1901), p. 319.

12 *The Essex Museum of Natural History*. By W. Cole, F.L.S., *Museum Handbook*, No. 3, 1900.

13 "The Museum Question." Report of Liverpool Geological Society, Vol. ix. (1901), p. xxvii.

principally casts, illustrating the famous case of the Ancestry of the Horse.

To all these collections which bear on natural evolution great value is imparted by the long descriptive labels, which have been drawn up by Mr. W. Cole. Not only here but all over the museum there are large labels and tablets, admirably composed, which make the collections self-interpreting, and offer to the visitor, who cares to read them, an excellent epitome of information on many branches of natural history. It is probable that by the casual visitor as he hurries through the museum they are unread and unheeded. Even the student who lingers over them may have but a faint notion of the labour involved in their composition. To put a scientific statement concisely yet clearly and in popular language is a task, the difficulty of which is known only to those who have had to face it. The labels in our museum are neat and legible, being either printed or type-written, whilst they appeal by their simplicity of expression to that unscientific individual, our familiar friend, who passes now-adays as the "man in the street." An American has said that our labels ought to be clear enough to "attract the newsboy and the boot-black."[14] I hardly think our critic would find much fault in this respect at Stratford.

The prime object of the Essex Museum is, of course, to illustrate the natural history of the county. The greater part of the *Invertebrata* are represented by a large and valuable collection of shells, crustacea, insects and other objects which are, or will be, preserved in two mahogany cabinets that have recently been placed in the museum. These beautiful cabinets contain upwards of 100 glass-topped drawers, each having a stop at the back so that it may be partially drawn out by the visitor, and its contents inspected without fear of damage. In this way the specimens will be preserved from deterioration by exposure to light, and yet remain freely accessible to the public.

Notwithstanding the efforts of the curator there are still many gaps in the local collection, and members of the Essex Field Club may be reminded that they have it in their power to render the museum very material aid by contributing from the spoils which they collect. Addressing the members of the

14 Mr. Harlan J. Smith on "Popular Museum Exhibits." Museums Association Report of Oxford Meeting. 1897. p. 65.

Woolhope and Cotteswold Clubs many years ago, the late Prof. John Phillips said, "I would urge all persons belonging to field clubs, not selfishly to retain the specimens they gather, but to deposit them where they may be of use to their fellow-explorers."[14] Such advice may be repeated with advantage to-day. Most members would, no doubt, be willing, if solicited, to share their captures with the museum, but they are probably not aware that such objects would be valued. Good examples of common things systematically collected are, however, much needed in many museums. It is a great encouragement to a young collector, who is not likely to secure rarities, to come to this museum and be able to identify the common species which he has collected.

By preserving the bulk of the local collection in cabinets much space is gained in the exposed table-cases for the exhibition of more attractive specimens not of local origin. While the prime function of the Museum is to illustrate the natural history of Essex, it has always been very properly regarded as a desirable object of the Club to render the collection of wide and even general educational value. Mr. W. Cole, in a suggestive paper, read seven years ago before the South-Eastern Union of Scientific Societies,[15] emphasized this idea, and advocated the formation, even in a small local museum, of what is often called a "type or index collection." As long as a student limits his studies to the products of a special area, he finds himself unable, in consequence of the serious gaps in every local collection, to take a general and systematic view of any organic group. My friend, Mr. H. M. Platnauer, the accomplished curator for so many years of the York Museum, has aptly remarked that "Teaching from a local collection was like teaching from a text-book from which whole chapters and many pages have been torn."[16] A visitor would form, in truth, but a poor idea of the group of the marine mollusca, for example, if he limited his attention to the shells of the Essex coast; but by the exhibition of a few typical shells from tropical seas, he gets a glimpse of the beauty and wealth of nature's resources in this department. Hence the table-cases in the Stratford Museum contain an

14 "On the Geology of the Malvern Hills."

15 "The Objects and Methods of a Local Museum." *Trans. South-Eastern Union Scien. Soc.* for 1897, p. 17.

16 *The Museums Journal*, vol. ii. (1902), p. 54.

attractive and instructive collection of mollusca, crustacea, and insects from all parts of the world.

The very effective manner in which this collection is displayed ought not to pass unnoticed. The molluscan shells, for instance, are placed on cotton wool in trays, whilst the crustaceans are mounted on a sand-like floor; nothing, too, can be more clear and striking than the labelling—white letters being used on a black ground with a vermilion border. Let it not be thought that such details are too trivial for mention at a scientific meeting; on the contrary they are matters of the first moment in rendering the collection attractive to visitors; and it is neglect of such small matters that has done much to bring museums into ill repute.

Whilst referring to the excellent manner in which the specimens throughout the Museum are mounted, I should ill discharge my duty if I made no mention of the labours of Mr. Whitehead, Mr. Cole's assistant, to whose skill and taste in displaying the specimens the Museum owes much of its attractiveness; nor should I omit reference to his wide range of knowledge and scientific enthusiasm, which render his services of such great value to the Institution.

Part of the Invertebrate Collection is exhibited on the walls of the staircase leading from the ground floor of the Museum to the Gallery. Here will be found representatives of the great groups of *Cœlenterata*, *Porifera*, *Echinodermata* and *Vermes*, mostly preserved in spirit. Even the fugacious jelly-fish from Southend is represented here. Nothing can be more effective than the manner in which the soft organisms are mounted on sheets of glass, with a suitable dark background, in rectangular glass jars. In fact, the use of the parallel-sided jar instead of a cylinder, and the employment of formalin as a preservative agent, have been the means, in recent years, of displaying such objects in a manner which contrasts most favourably with the unsatisfactory methods of exhibiting "spirit specimens" in old-fashioned museums.

The lower *Vertebrata* are represented by an excellent collection of local *Fishes*, beautifully arranged in the alcove on the right hand of the visitor as he enters the museum. Here are numerous specimens, some stuffed and others preserved in spirit, illustrating the fish-fauna, not only of the freshwaters of Essex, but also of the shallow part of the North Sea which washes the

coast of our county. A chart shows the physical conditions of the North Sea, whilst a large series of coloured plates, from Couch's work, serves further to illustrate the local ichthyology. Let the anglers in the Essex rivers never forget that certain freshwater fishes are still wanted to complete the collection ; and, I believe, that some of the less common marine species are also needed.

In a glass case on the left of the entrance an attempt is made to illustrate the *Amphibians* and *Reptiles* of Essex. A fairly complete set of the *Mammals* of Essex, with skulls and skeletons of many species, is at present placed in the Small Hall, near the Curator's Room. The *Birds* of Essex are represented by a series of stuffed specimens in the glass cases which run round the walls of the museum, whilst these birds are associated in many cases with their nests and eggs, forming groups which offer an interesting insight into local bird-life. Many of the ornithological specimens are due to the generosity of Dr. Laver, of Colchester, who has also presented valuable collections of local lepidoptera and land and fresh-water shells.

It is the intention of the Curator to collect a series of specimens of local interest, in illustration of *Economic Zoology*, including especially the Mollusca and Crustacea which come into London from the estuary of the Thames and other parts of the Essex coast. Such a collection would do much to excite an interest in familiar objects, and might be useful as serving to show the visitor that science does not stand aloof from the incidents of daily life.

In the Small Hall, to which reference has been made above, there is now exhibited a small collection of *Prehistoric and other Antiquities*, including many objects of local interest, especially the relics from the Dene-holes, the Red Hills, and the settlement at Braintree. Further reference to these is rendered unnecessary, however, by the excellent descriptions in the little handbook by Mr. F. W. Reader.[17] Although scarcely coming within the scope of a museum mainly devoted to natural history, I should like to see our museum possess a *Technological Department*, in which the industries of Essex should be illustrated, especially those which are extinct or tending to extinction.

17 *A Handbook to the Collection of Prehistoric Objects in the Essex Museum of Natural History*. By F. W. Reader.

A part only of the Gallery of the museum is at present given up to the natural history collections, but as these are rapidly increasing it is hoped that additional space may be secured in this section of the building, where the illumination by means of a direct top-light is well adapted for the display of objects requiring close inspection. The *Botanical collection* is located in the gallery. During the season fresh cut flowers are here exhibited week by week, as at the Forest Museum ; and the visitor is introduced to them by means of tablets adorned with charming little coloured sketches by Mr. Henry Cole. Here, too, are the *Mineralogical* and *Petrological* collections in course of arrangement by the skilful hands of Mr. Thomas W. Reader; and here, likewise, is the collection of *Fossils*—a collection containing many choice specimens, due chiefly to the generosity of Dr. Horace T. Brown, Mr. W. H. Dalton, and Mr. Carvalho. As an introduction to this section of the museum there is a most instructive series of specimens illustrating the phenomena of fossilization, and intended to answer the question which is asked by a bold tablet at the head of the case : " What is a fossil ?"

In dealing with fossils a Curator is at once faced with the vexed question whether they should be arranged independently as a palæontological collection, or be associated with the zoological and botanical specimens as one series—the extinct and the extant forms taking their place in juxtaposition. A fossil may in fact be viewed in two aspects: as a " medal of creation " it has an obverse and a reverse. The biologist looks at one side, the geologist at the other. To the biologist the fossil is a link in the chain of life, connected with other links on its two sides—a unit in a long organic concatenation related to certain antecedents and to certain successors. But the geologist, whilst fully appreciating this philosophical aspect, views the fossil as an index to a certain set of strata, as a representative of life at a particular period of the earth's history.

After all, this question, whether a Curator should arrange his fossils on the biological or on the geological system, seems rather like the old question, " Whether the tailor should make coats or trousers." To which the very obvious retort was, " Why not make both ?" If the museum is extensive enough, there can surely be no valid reason why the two systems should not be followed. The Curator, realizing this, will do his best to satisfy at once the student of Life and the student of Time.

Even in the Essex Museum, though far from being large, an attempt has been made in a small way to carry out this dual scheme. A case stands, for example, in the Hall, containing both living and fossil forms of the Cephalopoda. Several fossil Nautili are here placed by side of the recent Pearly Nautilus; and some typical Ammonites are to be found close by; whilst a group of Belemnites keeps company with spirit preparations of the calamaries and the cuttle-fishes of the Essex coast. In the Gallery, again, will be found a very instructive case of certain extinct animals associated with their living representatives.

But whilst these series are arranged to illustrate in some measure the biological side of Palæontology, the bulk of the fossils will be found arranged, as is usual elsewhere, on a chronological system. By disposing them in stratigraphical sequence, the student gets a notion of the fauna and to some extent of the flora at successive periods of geological history. To Mr. W. H. Dalton the Club is much indebted for having expended a great deal of labour on the arrangement of the Fossils, and especially for writing a Handbook[18] descriptive of the Pliocene fossils which have rendered East Anglia geologically famous, and of which, notwithstanding the ravishes of denudation to which Mr. Spiller has lately called attention, Essex can still boast a characteristic example in those shelly sands of Walton-on-the-Naze, which are believed to represent the oldest part of the Red Crag.

From this rapid survey of the contents of the Essex Museum and their arrangement, it will be seen how admirably the objects for which the Museum was originally organized have been so far carried out. The division into a Local and a General Collection is well defined. This division is in harmony with the views of most of those who have given thought to the Museum question. Mr. John Hopkinson, for instance, in suggesting to the Hertfordshire Natural History Society many years ago a scheme for the formation of a County Museum, insisted on the importance of dividing every Provincial Museum into two parts—one representative of a definite district, generally a county, and the other an educational department with a typical collection chiefly for the purpose of teaching.[19]

18 *A brief sketch of the Crag Formation of East Anglia.* By W. H. Dalton, F.G.S. Essex Field Club, Museum Handbooks, No. 4, 1900.

19 "The Formation and Arrangement of Provincial Museums." *Trans. Herts. Nat. Hist. Soc.*, Vol. i. (1881), p. 193.

The late Sir Wm. Flower, whose life was devoted to the highest type of museum work, pointed out, in his famous British Association address, that a museum should have a two-fold object—Research and Instruction.[20] The part devoted to research would be consulted only by those favoured few who had ability and opportunity for enlarging the bounds of knowledge, and consequently this portion need not be exhibited, but should be reserved for secluded study by the specialist. Such an arrangement is, perhaps, hardly applicable to a small museum like ours at Stratford; yet even there we are following, to some extent, the lines indicated, inasmuch as specimens prominently displayed to the public are such as should attract the general visitor, whilst the local collection for consultation by the serious student is preserved in cabinets, though those are accessible to all.

My friend, Dr. Bather, in a valuable address delivered a short time ago to the Museums Association at Aberdeen, took a wider view of museum organisation, and held that a typical museum has three functions—Investigation, Instruction and Inspiration.[21] As an aid to investigation the Museum is consulted by the specialist who is occupied in original research; as a means of instruction it is used by the ordinary student, the amateur and the collector; as an aid to inspiration it appeals to the lay public, the rank outsider, the man in the street. Our Essex Museum, though appealing to the ordinary student, is largely concerned with the last of these functions—it seeks to attract and elevate the general public of West Ham. Our purpose, to borrow Dr. Bather's words, is "not to turn every member of the gaping crowd into a doctor of science, but to awaken their imagination and interest, and to give to a street-bred folk some feeling for the nature it has well-nigh forgotten. The love of nature is the essential thing; the questioning of her will follow."

It may, perhaps, be said that theoretically we need three museums, one for each type of visitor—the specialist, the student and the stranger. The first and the second type of museum may be united, so may the second and third, but the first and third types are generally as little disposed to union as oil and water.

20 *Rep. Brit. Assoc.* Newcastle-on-Tyne, 1889, reprinted in *Essays on Museums*. London: 1898, p. 1.

21 *Rep. Mus. Assoc.* Aberdeen meeting, 1903. See also his paper on "The Functions of Museums," in the *Popular Science Monthly*, Jan., 1904, p. 210.

All we can hope to do in our small museum is to appeal to the student and the stranger; whilst the specialist, bent on original research, will naturally turn to more important institutions, generally to the British Museum.

Considering the magnitude and importance of our National Museum—the pride of British science—it seems amazing that its existence goes no further back than some hundred and fifty years. It was first opened to the public at Montague House, on January 15th, 1759, only, however, for three hours a day; and indeed for long afterwards the admission was restricted by complicated regulations, which were no doubt considered necessary at the time but which seem to us, looking back from these days of freedom, to have been of a most vexatious character.[22]

The original nucleus of the British museum, around which the magnificent national collections have aggregated in the course of a century and a half, was the private museum of Sir Hans Sloane. Sloane—the intimate friend of Boyle and Ray, and the immediate successor of Newton in the Presidential chair of the Royal Society—had not only made a great collection himself, begun in early life during his sojourn in the West Indies, but he succeeded in 1701 to the valuable collections of his friend William Courteen. In 1684, Courteen, who had lived much on the continent, opened a suite of rooms in the Temple, and there arranged his collections, on which he had spent the greater part of his fortune, and which he valued at £50,000. Yet the sum paid by the nation in 1753 for the Sloane museum at Chelsea, including Courteen's specimens, was but £20,000—a sum which, according to a codicil to Sloane's will, was not a quarter of their intrinsic value. The Act of Parliament which was passed for the purchase of the Sloane collection and the Harleian manuscripts was also directed to "providing one general repository for the better reception and more convenient use for the said collection." Such was the orgin of the British museum. It is this repository which has gradually expanded into the splendid institutions at Bloomsbury and South Kensington.

22 Walter Harrison in his "History" gives the following description of the mode of gaining admittance to the Museum:—

"If any number, not exceeding fifteen, are inclined to see it, they must send a list of their christian and surnames, with their place of abode, to the porter's lodge, in order to their being entered in the book; in a few days the respective tickets will be made out, specifying the day and hour when they are to come; which, on being sent for, will be delivered. The fewer names there are on the list, the sooner the company will gain admittance."

Previously to the foundation of the British museum, the great museum in London was that of the Royal Society. The formation of a Museum has generally been considered to be legitimately included in the work of any society devoted to the advancement of science; and the Essex Field Club has consequently been simply a humble follower in this direction. Bishop Sprat, in describing the early doings of the founders of the Royal Society after the Oxford Meetings were broken up and they had settled in London, tells us that:—

"As soon as they were reduc'd into a *Fix'd Assembly*, one of the Principal Intentions they propos'd to accomplish, was a General Collection of all the Effects of *Arts*, and the Common, or Monstrous *Works* of *Nature*. This they at first began by the casual Presents, which either *Strangers*, or any of their own Members bestow'd upon them. And in short time it has increas'd so fast, by a contribution from all Parts, and chiefly by the bounty of Mr. *Colwal*, that they have already drawn together into one Room, the greatest part of all the several kinds of things, that are scatter'd throughout the *Universe* (!). The Keeping, and Ranging of these into order, is committed to Mr. *Hook*, who had also the honour of being made the first *Curator* of the *Royal Society* by election." [23]

Writing to Mr. Boyle on February 3, 1666, Hooke, the Secretary of the Royal Society, says "I am now making a collection of natural rarities, and hope within a short time to get as good as any that have yet been made in any part of the world." About this time, the Council resolved "that the donation of £100, presented by Mr. Colwall, should be expended in purchasing the collection of rarities formerly belonging to Mr. Hubbard."

Dr. David Murray in his recently published work on museums, [23*] suggests with much plausibility that this "Mr. Hubbard" was really Robert Hubert *alias* Forges, who is known to have had a large collection of rarities, which he exhibited publicly in 1664 at "the place called the Musick House, at the Miter near the west end of St. Paul's Church." Of this collection a catalogue exists, and many of the objects are

23 *The History of the Royal Society of London*, for the improving of Natural Knowledge. By Tho. Sprat, D.D., Lord Bishop of Rochester. London: 2nd ed. 1702. P. 251.

The "Curator" of the Royal Society was an officer who attended to the experiments, etc.

23* *Museums: their History and their Use.* By David Murray, LL.D., F.S.A. 3 vols. Glasgow. 1904.

It was not until after this Address had practically been finished that I had an opportunity of consulting this valuable work. Had I seen it earlier I should have used it more freely. In working up the history of the subject I was familiar with the chapter on "Collections of Natural Curiosities" in Beckmann's *History of Inventions*, and with Prof. Newton's paper and a few other short notes; but struck with the scarcity of information on the subject, I had said, in the draft of the address, "The history of museums has yet to be written." Before the time came, however, to deliver the address Dr. Murray's comprehensive volume had made its appearance

evidently those which afterwards figured in the Royal Society's Museum.

As soon as the Society thus acquired the nucleus of a collection, donations flowed in rapidly, including many objects of a rather curious character. Sir Robert Moray, for instance, presented "a bottle full of stag's tears"—reputed at that time to possess much medicinal value. We have not, I believe, yet procured for our Museum a similar specimen as a relic of the red deer of Epping Forest.

When Boyle died in 1691 it was found that he had bequeathed to the Society his mineral collection, or as he described it, "all my raw and unprepared minerals as ores, marchasites, earths, stones (excepting jewels), etc., to be kept among their collections of the like kind, as a testimony of my great respect for the illustrious Society."[24]

But before the time of the Boyle bequest the collections had grown so large that it was felt necessary to have a catalogue. Accordingly, at a meeting on July 18, 1678, it was ordered "That Dr. Grew be desired at his leasure (*sic*) to make a Catalogue and Description of the Rarities belonging to this Society." At that time the Repository, as it was called, contained, we are told, "several thousand specimens of zoological subjects and foreign curiosities." Nehemiah Grew, who was commissioned to compile the catalogue, was a very learned, versatile, and industrious man, especially distinguished for his researches in vegetable physiology. He seems to have completed his catalogue within a year, though it was not published until 1681, when it appeared as a folio of 388 pages, with an anatomical supplement of 43 pages. It was dedicated to Daniel Colwall, a wealthy citizen, described as Founder of the Museum, and his portrait forms the frontispiece.[24*]

The catalogue is in many places very quaint and amusing reading, and offers an insight into the state of natural history two centuries ago. In 1682 Grew was appointed to take charge of the Repository under the title of "Præfectus Musei Regalis Societatis," and he was requested to "make a short catalogue of

24 The quotations are from *A History of the Royal Society*. By Charles Richard Weld. London: 1848.

24* *Musæum Regalis Societatis, or a Catalogue and Description of the Natural and Artificial Rarities belonging to the Royal Society, and preserved at Gresham College.* Made by *Nehemiah Grew*, M.D. *Whereunto is Subjoined the Comparative Anatomy of Stomachs and Guts. By the same Author.* London: 1681.

the Raritys, with a method for the ready finding them out." They were indeed a very miscellaneous collection, including, according to the catalogue, not only all kinds of animals, plants, and minerals, but also metals and chemical products, physical apparatus and models, coins and various antiquities, ethnological objects, and curios in general. In fact, so august a body as the Royal Society seems in those days to have regarded a museum much as Horace Walpole regarded it at a later date, as "A hospital for everything that is singular."

When the Government granted rooms to the Society no space was provided for the museum, and consequently on removal from Gresham College the collections were presented to the newly-established British Museum. The Royal Society's Museum, after a life of rather more than a century, ceased to exist as such in the year 1779.

I am not ambitious enough in this address to attempt to trace, even in the barest outline, the general history of museums. Where was the first museum, and who was its curator, are questions which no man is ever likely to answer. Reference has often been made to the collections of Aristotle and other naturalists of classical antiquity, and to the treasures of Solomon and Hezekiah; whilst some writers have even been bold enough to suggest that prehistoric man was not without his little Museum. Forty years ago M. Dupont discovered in a limestone cavern on the bank of the river Lasse, in Belgium, a collection of fossil shells, including the gigantic *Cerithium*, which must have been brought a distance of 40 or 50 miles, with a piece of fluor-spar, and various other objects. Possibly they were brought together as mysterious objects for worship, or perhaps only as personal decorations; but the late Mr. G. H. Morton, of Liverpool, thought it more likely that they were collected as mere curiosities—prehistoric curios.[25]

As practical people, however, it is more to our present purpose to utilize the brief time at our disposal in dealing with the museums of our own country, in comparatively modern times.

At the time the Royal Society founded its Museum, the only collection of importance in this country seems to have been that

25 "Museums of the Past, the Present, and the Future." *Proc. Liverpool Nat. Field Club* for 1893.

of the Tradescants.[26] John Tradescant, the elder, who travelled as a botanist, and was gardener to Queen Henrietta Maria, is described by an old writer as "a painful industrious searcher, and lover of all Nature's varieties," but his tastes were not confined to natural history, and the museum which he formed at Lambeth became an *omnium gatherum*. The collections were augmented by his son John Tradescant, who in 1656 published a catalogue of his "Rarities," which he described as being "more for variety than any one place known in Europe could afford."[27] The museum, known as "Tradescant's Ark," became one of the curiosities of the age—"a world of wonders in one closet shut." Prof. Newton, of Cambridge, has referred to the two Tradescants as "the parents of British Musæology,"[28] and as such they command our profound homage.

It appears that the second Tradescant made over his "Closet of Curiosities" by deed of gift, in 1659, to his friend Elias Ashmole, but by a will of later date bequeathed the collection to his wife, for her life. This led, unfortunately, but not unnaturally, to litigation. After a while, however, the museum passed to Ashmole, whose name it afterwards bore.

Ashmole, who thus became possessed of the extensive collections of the Tradescants, was a learned man of versatile tastes, leaning especially towards heraldry, astrology, and alchemy. A liking for botany seems to have attracted him to Tradescant, with whom at one time he lodged. On acquiring the "Ark," he built for its reception a house in South Lambeth, adjoining that previously occupied by Tradescant. After retaining the collection for some years, and much enriching it, he offered to present it to the University of Oxford, provided that a suitable building were erected for its reception. This condition having been accepted, the "Ashmolean Museum" was built from plans, said to be by Sir Christopher Wren; and in 1682, twenty years after the death of the younger Tradescant, the collection was removed in twelve wagons from Lambeth to Oxford. Dr. Plot, the historian of Oxfordshire and Staffordshire, became the first curator. In an old essay on the "History of Museums," read before the

26 Excellent biographies of the Tradescants, by Prof. G. S. Boulger, will be found in the *Dictionary of National Biography*.

27 *Musæum Tradescantianum; or a Collection of Rarities preserved at South Lambeth, neer (sic) London.*" By John Tradescant. London: 1656.

28 "Notes on some old Museums." By Alfred Newton, M.A., V.P.R.S. *Rep. Museums Assoc.*, Cambridge Meeting, 1891, p. 32.

Ashmolean Society, the author says "It is agreed on by all our antiquaries that the Tradescant collection, which was the foundation of the Ashmolean Museum, was the earliest exhibited in Britain."[29]

On the Continent, however, there were collections of no mean importance a hundred years earlier. A printed catalogue exists, for instance, of the Kentmann Cabinet, dated 1565. Johann Kentmann was a physician, who lived at one time at Torgau in Saxony, and afterwards at Dresden. The doctor had collected about 1,600 specimens, chiefly minerals and fossils, with a few shells, corals, and other marine objects, and preserved his collection in an ark, or cabinet, of 13 double drawers, figured in the catalogue. This catalogue was published by the doctor's good friend Gesner, in a volume which contains also a number of scientific essays, including a treatise on precious stones and other minerals.[30]

Conrad Gesner, who has been styled "The German Pliny," seems to have been one of the most remarkable men the world has ever seen. At one time he was professor of the Greek language, at another time professor of medicine, and again we hear of his holding a chair of philosophy. His industry was prodigious, for though he died before he was fifty years of age (*b.* 1516, *d.* 1565) he left a vast number of works relating to most diverse subjects. Every branch of natural history secured his sympathy, and he formed a collection much larger and more important than Kentmann's, though I am not aware that a catalogue of it is included in his writings. To accommodate this collection he built at Zurich a Museum surrounded by a botanic garden. It is related that knowing his end was approaching he had a couch placed in his Museum and was carried thither, so that he might expire in the midst of those objects to which he was so devoted. It is with good reason that Gesner has been called the "Father of Natural History Museums."[31] His collection passed, on his death, to his friend Felix Plater, a doctor in Basle,[32] who possessed a notable collection.

29 *A Catalogue of the Ashmolean Museum.* Oxford : 1836.

30 *De Omni Rerum Fossilium Genere, Gemmis, Lapidibus, Metallis et hujusmodi, Libri aliquot, plurique nunc primum editi. Opera Conradi Gesneri.* Tiguri : MDLXV.

31 Presidential Address by Rev. Henry H Higgins, M.A. *Report Museums Assoc.*, Liverpool Meeting, 1890.

32 *Conrad Gesner : Ein Beytrag zur Geschichte des Wissenschaftlichen Strebens und der Glaubensverbesserung im 16 ten Jahrhundert.* By Johannes Hanhart. Winterthur: 1824. p. 270.

Our illustrious countryman, Ray, in passing through Basle, visited Plater's Museum, which he describes as "a good collection of minerals, stones, metals, dried fishes, and other natural and artificial rarities," and he goes on to say that these were "disposed in a good method, the names being set to each one.[33] Plater had evidently the methodical instinct of the true curator.

Gesner's museum carries us back at least 350 years, but we might pursue the history of museums to a much more remote period, for we know that there were collections of natural objects occasionally made by men in advance of their generation. To us, however, it is more interesting to note the character of the museums which satisfied the wants of our forefathers in less remote times.

During the eighteenth century, and even later, there were several proprietary museums opened in London and elsewhere as shows. Probably the most famous was that of Sir Ashton Lever. Born at Alkrington, near Manchester, in 1729, he developed in early life a great taste for collecting, and being possessed of ample means, acquired a large collection. This he removed, in 1774, from Alkrington Hall to London, and he then exhibited it at Leicester House, in Leicester Square. He styled his exhibition the "Holophysikon," and charged each visitor 5s. 3d. for admission. Having spent a very large sum on his museum his affairs became embarrassed and he offered his collection at a very moderate price to the trustees of the British Museum. By them, however, it was declined. Lever then obtained parliamentary power to dispose of it by lottery, the value officially put upon it being £53,000. At the lottery the prize fell to a certain James Parkinson, who had been a law-stationer and estate agent. He not unnaturally endeavoured to dispose of it, and seems to have entered into negotiations with people of importance, like the Queen of Portugal and the Empress of Russia; but these negotiations fell through, and as the rent of Leicester House was considerable he purchased a piece of ground in Albion Street, Southwark, in which he erected a building that came to be known as the Rotunda.[34] To this museum the admission was half-a-crown, and for some years

33 "Travels through the Low Countries, Germany, Italy, and France." 2nd ed., 1738, p. 85.

34 A view of the interior of the Museum is engraved as a frontispiece to the Catalogue, entitled *A Companion to the Museum (late Sir Ashton Lever's). Removed to Albion Street, the Surrey End of Black Friars Bridge.* London, 1790.

it flourished as one of the sights of London. An American naturalist, C. W. Poole, describing a visit to London in 1800, says :—" The trouble to obtain a sight of the British Museum renders it of less value to the public than a private collection belonging to Mr. Parkinson, called the Leverian Museum." Eventually, however, the popularity of this museum declined, and in 1806 it was sold by auction—the sale extending over 65 days, and including 7,819 lots. The Rotunda was afterwards used for some time as a scientific institution.

Another metropolitan museum, well known in the early part of the last century, was Bullock's Museum, which had the advantage over Lever's of a more central situation, and a smaller admission fee. William Bullock was originally a silversmith and jeweller in Lord Street, Liverpool, where he opened, in 1801, a Museum of Natural and Artificial Curiosities, which he described as " comprising upwards of 800 objects." The admission to this modest collection was 1s., or by an annual ticket costing 10s. 6d. After removing his collection to other premises in Liverpool, he brought it, in 1809, to London, and exhibited it at No. 22, Piccadilly, at first under the name of " the Liverpool Museum." By this time the original 800 specimens had increased to 7,000, described as " Natural and Foreign Curiosities, Antiquities, and Products of the Fine Arts," which had cost the owner £20,000. Its popularity was so great that Bullock was led to build for its reception the Egyptian Hall. This remarkable building, now about to be pulled down, was erected in 1812, from the designs of Mr. P. F. Robinson, at a cost of £30,000. When transferred to the " Egyptian Gallery " the collection became known as the " London Museum," and was described by the owner, in his guide book, as consisting of upwards of 15,000 specimens " collected during 20 years of unwearied application, and at an expense exceeding £30,000." Mr. Bullock refers to his museum as " an Establishment for the Advancement of the Science of Natural History, which in magnitude and expense, he presumes, is unparalleled as the work of an individual."[35]

In 1819, Bullock's collection was brought to the hammer, the sale including 3,331 lots, extending over 26 days, and realizing about £12,000. After the sale, Bullock went to Mexico, and

35 " A Companion to the London Museum and Pantherion, containing a brief description of upwards of 15,000 natural and foreign curiosities, antiquities, and productions of fine arts ; now open for public inspection at the Egyptian Temple, Piccadilly, London." By William Bullock.

formed large collections which he brought home and exhibited in the Egyptian Hall, in 1824, in the form of two exhibitions called "Ancient Mexico" and "Modern Mexico." From the guide-books which I possess to all his exhibitions it is clear that Bullock was a man of much enthusiasm for natural history and archæology.

Before the days of the large museums of Lever and Bullock, it was the custom to form small collections at houses of refreshment as an attraction to the customers. Of these, perhaps, the most famous was that in Cheyne Walk, Chelsea, opened in 1695 by the eccentric John Salter, known as "Don Saltero." He had been for many years in the service of Sir Hans Sloane, who had given him most of the specimens with which he started the museum that he called the "Chelsea Knackatory." Steele speaks of "ten thousand gimcracks round the room and on the ceiling." The miscellaneous assemblage of things included, however, a large number of natural-history objects. Faulkner, the historian of Chelsea, refers to "a great variety of petrifactions, corals, chrystals, ores, shells, animals preserved in spirits, stuffed animals from various parts of the world, idols, curious Chinese manuscripts, missals, birds, snakes, butterflies, medals," etc. It is the custom to smile and sneer at these old miscellaneous collections, but Faulkner sympathetically remarks that they "cherished the infancy of science, and should not be depreciated now, as the playthings of a boy are scorned after he has arrived at manhood."[36]

When Don Saltero's collection of curiosities was sold by auction in 1799, the total amount realized was but little over £50!

The days of Salter's "auld knick-knackets" are over, but even at the present day collections of curiosities at public places of refreshment are not altogether unknown; witness, for example, the museum of the Edinburgh Castle, in Camden Town, which has become quite famous for the eggs of the Great Auk.

Let us turn now to the county in which our Club is specially interested. Whether any antiquary has ever been able to ascertain when the first museum was formed in Essex, I know not. Probably here as elsewhere private collections have always been

36 *An historical and topographical description of Chelsea and its Environs.* By Thomas Faulkner. London: 1829, vol. 1, p. 382.

made, more or less systematically by students of natural history, though such collections might never rise to the dignity of a museum. Our great Essex naturalist, John Ray, must surely have possessed a collection. His friend and benefactor, Francis Willughby, we know collected extensively and secured the advantage of Ray's curatorial assistance. In a letter to Martin Lister, dated June 18, 1667, Ray says: "The most part of the winter I spent in reviewing and helping to put in order Mr. Willughby's collection of birds, fishes, shells, stones, and other fossils; seeds, dried plants, coins, etc." [37]

It is clear therefore that the Willughby collection was of a very comprehensive character. Ray, being a man of restricted means, could hardly indulge in a similar manner, however wide his sympathies may have been; but that he had some kind of collection is clear, for we are told that "whatever he had preserved relative to any branch of natural history he gave before his death to his neighbour, Mr. Samuel Dale." [38] The Ray collection therefore passed to his executor, and the herbarium was presented by him to the Physic Garden at Chelsea, but ultimately found an appropriate resting place in the British Museum.

One of the earliest, and still one of the best, natural history museums ever founded by a local society in this country is the museum at Saffron Walden. Soon after the foundation of a Natural History Society in that town, in 1832, it was resolved "that a museum be founded to include specimens in the several departments of natural history, with antiquarian remains and such other articles as might be of general or local interest." The collections were accommodated at first in the house of Mr. Jabez Gibson, who had been mainly instrumental in organizing the society, but in 1834 they were removed to the building specially erected for their reception by Lord Braybrooke. This museum was opened on May 12th, 1835.

That the special value of a local collection was recognized at that time is evident from a statement circulated before the building was opened, in which it was said that "the concentration of Specimens peculiar to the District in which the Museum is established will form a leading feature in its

37 Dr. Derham's Life in *Memorials of John Ray*. Edited by Edwin Lankester. Ray Society: 1845, p. 17.

38 Sir J. E. Smith in the Ray Society's volume, p. 85.

arrangement." At the same time the collections included specimens from widely distant parts of the world, and these of such exceptional interest in certain cases that the museum positively surpassed at that time the British Museum. The skeletons and skins of the African elephant and the two-horned rhinoceros were said to be the earliest ever known in this country; indeed, the specimen of the African elephant, stuffed by Mr. Joseph Clarke, was considered to be of such interest that it was sent to the Great Exhibition of 1851. Many of the larger mammals were due to the generosity of Mr. George Wombwell, the proprietor of the menagerie, who took, from his local association, great interest in the museum.

It is a notable proof of the intelligence and enterprise of the organisers of this museum that within ten years of its foundation they published an admirable catalogue.[39] Sixty years have slipped by since that work was issued, and during this time science has indeed made startling progress, yet it may be fairly said that the production of such a catalogue—so carefully compiled, admirably printed, and delicately illustrated—would be creditable to any provincial museum even at the present day. From the frontispiece we get an insight into an Essex Museum sixty years ago, and the view is one in which an Essex man may justly feel pride! We are not surprised that, according to Mr. Miller Christy, the catalogue "is said to have been the best of its kind in existence at that day."[40]

Since the Saffron Walden Museum was founded, now seventy years ago, the museum movement, at that time scarcely recognised, has made marvellously rapid progress. In 1845, the year in which the Saffron Walden catalogue was published, an Act was passed by the Legislature, enabling certain municipal bodies to levy a rate for the establishment of museums of science and art. From this small beginning we have advanced, until at the present day most of our museums are under municipal authority, so that, unlike museums belonging to local societies they enjoy an income which though it may be small is yet officially assured. Without such support by the West Ham Corporation, where would be our Essex museum!

When we remember the difficulty of formerly obtaining access to the British Museum, when we remember too that to see

39 *An Abridged Catalogue of the Saffron Walden Museum.* 1854.
40 *The Birds of Essex.* Essex Field Club Special Memoirs, vol. ii., 1890.

the Leverian museum in Leicester Square the visitor had to pay at least five shillings, we ought indeed to congratulate ourselves that our lot is cast in such enlightened times that we have municipal museums freely scattered throughout our land, which may be visited by anyone without entrance fee or other hindrance. The museum has come to be recognised, in the words of Mr. E. Howarth, as "an essential element of municipal life."[41] It is hardly too much to say that every free library should have associated with it a free museum. Indeed, many who have given much thought to the matter have been led to conclude that the museum is perhaps in some respects the more important of the two institutions. "Museums," said Professor Boyd Dawkins, "appeal to the interest of many, while books and a taste for books interest a narrower circle."[42] Turning to the admirable speech delivered by the Countess of Warwick, at the opening of our Essex museum, we find the opinion expressed that "the foundation of a local museum for purposes of study and reference is as valuable—perhaps even more valuable—than a public library, for the drift of modern thought in the direction of scientific education is towards a knowledge of nature rather than a knowledge of books."[43] It is obvious that the young student learns more by direct relation with the concrete natural objects—the minerals, the plants, the animals—even if he merely sees them in glass-cases—than he can possibly learn about them by mere reading. An American writer has remarked that "the near future may well see as great an interest in the establishment of museums as there is now in the founding of libraries.[44]

The day has gone by when people could afford to sneer at local museums—"the little museums accumulated for the service of science by the philosophers of all our country towns."[45] It must be admitted that the old type of provincial museum founded by the enthusiasm of a few members of a local society usually left much to be desired. When the founders passed away, it often became difficult, sometimes impossible, to find successors who would carry on the work of the museum, and the collections were consequently doomed sooner or later to

41 *Report, Museums Association*, Canterbury Meeting, 1900, p. 76.
42 *Ibid.* Manchester Meeting, 1892.
43 ESSEX NATURALIST, Vol. xi. (1900), p. 325.
44 "The Opportunity of the Smaller Museums of Natural History."—*Popular Science Monthly*, May, 1903, p. 40.
45 *A Second Letter to a Dissenter on the Opposition of the University of Oxford to the Charter of the London College.* By the Rev. W. Sewell, M.A., 1834.

fall a prey to neglect. Hence, there was little to induce the possessors of valuable objects to give them to the local museum. But all this is now changed. Public opinion to-day recognises that the care of the local museum is as much a part of the duty of the Corporation as the care of the public roads. "The one vital principle which surrounds Corporations," says Mr. Greenwood, "is that they are gifted with perpetual life."[46] Anyone therefore who gives a collection to a municipal museum feels that its care is permanently assured.

Since the Essex Field Club was founded, a quarter of a century ago, there has been a great advance in the popular appreciation of museums. An important step was taken in 1886, when the British Association appointed a committee to report upon the Provincial Museums of this country. The reports of this committee drawn up by the late Mr. F. J. Mott as Secretary, form a valuable repertory of information.

But a far more important step was taken by the formation, in 1889, of the Museums Association. Then, for the first time, the Curators throughout the country became organised. At the annual meetings of this Association the Curators and others interested in museums meet in conference, so that all matters of museum economy can be fully discussed by experts. Those who wish to know something about modern museums will find information of the most valuable character in the Annual Reports and in *The Museums Journal*, which is the organ of the association. Here the reader is made acquainted with the most recent methods of museum work, and will thus realise the admirable manner in which most of our provincial museums are becoming organised.

As an example of a museum which in spite of very restricted space, and with only moderate resources, may yet profit by the modern system of museum *technique*, we may point with some pride to our own museum at Stratford. Let it ever be remembered, however, that the maintenance of a museum, worthy of the present day, involves an immense amount of labour. It was a remark of the late Sir William Flower, that "a museum is like a living organism—it requires continual and tender care. It must grow or it will perish."[47] No words could be more just. However carefully a collection may be arranged, it will, if left to

46 *Museums and Art Galleries.* By Thomas Greenwood, London 1888.

47 *Essays on Museums* p. 13.

itself, inevitably degenerate. The tender care of the Curator is needed incessantly. The Rev. H. H. Higgins, who was for so many years the enthusiastic honorary Curator of the Liverpool Museum, well said that "the Curator is the soul of the museum"—a sentiment endorsed by most authorities on museum organization. Yet how often does it happen that as we pass through a well-arranged museum we forget the Curator! The visitor seems usually to think that the specimens are able to shuffle about and arrange themselves in scientific order. But if in the midst of an orderly arrangement there should be some small part of the collection in an unsatisfactory condition, the Curator is then by no means forgotten. In accordance with the common tendency of human criticism, we are apt to overlook the bulk of the collection in all its fair aspect, and centre our attention on the disfiguring speck.

However devoted and however smart a Curator may be, he finds it impossible to make bricks without straw. In order that his museum may be in creditable condition, he needs all the neat appliances which are now in the market for mounting and displaying specimens; he needs the best books of reference for the identification of the objects which pass through his hands; he requires assistance at least to carry out such mechanical details as mounting and labelling. Above all, the cases and cabinets in the museum must be of the best construction, so as to protect their contents from dust and other sources of deterioration. If we have any regard for our collection, it will be found the worst possible policy to buy cheap cabinets. Taking all this into consideration, a museum is often denounced as an expensive fad. Never was there a greater mistake; it is not a fad, and considering its value to the community it is not expensive. "If you compare its cost with that of any other part of our educational machinery, I maintain," said Mr. Charles Madeley, "that it is exceedingly cheap."[48]

Admitting the value of Museums, under certain conditions, objection has sometimes been taken to their multiplication. It has been held that in proportion as they become common they will cease to be impressive. We in London surely cannot want them. What need can there be to have small Museums in or near the metropolis, when we have the doors of the

48 "District Museums." *Museums Journal.* vol. IV. (1904). p. 117.

National Museum always open in our very midst! Everything that we can hope to shew in a small museum, may certainly be found in the British Museum.

I have already referred, however, to the bewildering effect of large collections. There is no question that the wealth of specimens is apt to throw the untrained visitor into a state of mental distraction. Mr. Thomas Greenwood has observed that "there is such a condition of mind as picture drunkenness or Museum drunkenness."[49] Depend upon it a small collection encourages concentration of attention, whilst a large collection tempts to diffusion of thought. Just as every student knows "it is better to digest a chapter than to read a volume," so it is far better to see a small collection, and remember what it teaches, than to range aimlessly over a vast museum.

Many years ago when it was proposed to establish a local museum at Wimbledon, Mr. Joseph Toynbee delivered an excellent address in which he advanced the view that in a large town or city, each parish should have its own museum, exhibiting the objects collected within a radius of five miles from the parish."[50]

No thoughtful person will despise a small museum, or object to such museums being multiplied, when he reflects on the utility of such humble institutions to the young people in their immediate neighbourhood. If any one desires to see what may be done with small means, let him visit the little museums at Stepney under the care of Miss Kate Hall.[51] This enthusiastic lady, by her admirable demonstrations, has made her museums living centres of light and learning to the children of the East End.

The subject of demonstrations is one of great importance in viewing museums from an educational standpoint. Many persons fail to feel interest in a visit to a museum merely because they have no one to direct them and offer simple explanations of what they see. A party of visitors will often sigh for some "museum Cook," who could personally conduct them round the institution. Such conduct, however, needs to be in capable hands. In the early days of the British Museum it was the custom for the attendants to take the visitors, in small parties,

49 *Museums and Art Galleries*, p. 29.
50 "Hints on the Formation of Local Museums. p 21.
51 See her paper, "The Smallest Museum," *The Museums Journal*, vol. i. (1902), p. 38

from room to room; but the practice does not appear to have been always satisfactory. At any rate a visitor in the beginning of the last century, was led to complain that the conductor treated the company to "witticisms on various subjects of natural history, in a style of vulgarity and impudence, which I should not have expected to have met in this place."[52]

Formal demonstrations in a museum are generally attended with more difficulty than most people imagine; and after much experience, both as a listener and as a demonstrator, I was led some years ago to suggest that the formal demonstration, or lecture, should be given in a neighbouring room rather than in the midst of the cases.[53] It is gratifying to find that at the Essex Museum arrangements are now being made, whereby a convenient room, with electric lantern and screen, will be placed at the disposal of those who desire to give demonstrations in illustration of the contents of the museum.

In a paper on the utilization of local museums read at the last meeting of the British Association, the Rev. W. Johnson, of York, described the excellent work of Mr. Crowther, the Curator in Leeds, in lecturing to the schools, which systematically visit the museum; and considering the great value of such work he strongly advocated its extension, with payment by the local authorities for the additional labour thus thrown upon the Curator. "This work," said Mr. Johnson, "is at any rate as well worthy of this support as are free libraries, or municipal bands, or art-galleries."[54]

Apart from formal lectures and demonstrations, a visitor to a Museum would often be glad of a description of some particular object, or group of specimens, of exceptional interest, and would be quite willing to pay a small fee for such a description by some competent person. Prof. Anton Fritsch, of Prague, has playfully suggested that the day may come when a visitor, standing in front of some interesting specimen, will have simply to drop a coin into a slot connected with a phonograph, and forthwith he will hear a short discourse on the specimen in the very words, nay, even the very voice, of some

52 *Journal of a Tour and Residence in Great Britain, in the years* 1810-1811. By Louis Simond. 1815. vol. i., p. 84.

53 "On the difficulties incidental to Museum Demonstrations." *Report Museum Association*, Cambridge Meeting, 1891, p. 71.

54 *Report British Association*, Cambridge Meeting, 1904.

distinguished professor."[55] Many a true word is proverbially spoken in jest, and, in conclusion, I commend this idea to our Curator, who happens to be much interested in talking machines. We already have in the Essex Museum, for the use of the public, a microscope and a spinthariscope. Why not a phonograph ?

In now relinquishing the honourable position to which your suffrages kindly, and quite undeservedly, called me two years ago, I am anxious to express my deep sense of obligation to the officers, the Council, and the members generally—but especially to the Honorary Secretaries—for the generous assistance and loyalty which they have uniformly rendered to me, and for the courteous indulgence which they have extended to me, during my occupation of the presidential chair. The pleasure with which I shall look back upon my tenure of this position will be greatly enhanced by the feeling that I am succeeded by one so much more worthy in every way to conduct the affairs of this important organization. In Mr. Miller Christy, the Essex Field Club has at once a local naturalist, who has made his mark by a standard work on the Birds of Essex, and an antiquary who is an acknowledged authority on many branches of county history—one who has always been zealous in his support of this Club in the past; one who will, I feel sure, be yet more zealous for its welfare in the future.

55 "The Museum Question in Europe and America." *The Museums Journal*. vol. iii. (1904), p. 248.

THE BRITISH WOODLICE.

By WILFRED MARK WEBB, F.L.S., and CHARLES SILLEM.

(*With Plates I.—XXV., and numerous other Illustrations*).

Introduction.—Having finished a somewhat exhaustive list of the land and fresh-water molluscs of Essex,[1] one of the present writers felt that if he were to make any further contributions of importance to a knowledge of the fauna of that interesting county, he must turn his attention to some other group of animals. It seemed most fitting that some creatures should be chosen which are commonly met with during the search for molluscs. Centipedes, millepedes, and woodlice fulfilled these conditions, and all were collected, but as only seventeen species of woodlice had at the time been found in England, it was deemed advisable to study these in detail to begin with. The present contribution is the result of the undertaking, and we have thought that a general consideration of the British Woodlice, with careful drawings from nature of all the species now known from this country, ought to lead to a more general study of these interesting creatures and their habits.

Position in the scheme of classification.—The Woodlice belong to an immense group of invertebrate animals known as the Arthropoda, the bodies of which are segmented and provided with jointed appendages for purposes of walking, swimming, and feeding. Of this group, two large divisions are recognized. The first contains the forms which breathe by means of air tubes, such as the Insects; and the second has been constituted for Crustacea, which breathe by means of gills. The latter are, of course, adapted more especially for a life in water, but here and there we come across examples so modified that they can exist in air. The land-crabs are a case in point, and so are the Woodlice. These belong to an order which contains many fresh-water and marine species, known as the Isopoda.

Geological history.—The known history of the order is a long one, for remains occur in the Old Red Sandstone (Devonian) of Herefordshire, and in the Coal Measures. (79[2]). A form

1 "The Non-Marine Molluscs of Essex," by Wilfred Mark Webb; ESSEX NATURALIST, Vol. x. (1897), pp. 27-48 and 65-81.

2 The numbers in brackets refer to papers mentioned in the Bibliography at the end.

which has been named *Archæoniscus brodiei*, and is said to be referable to the recent family Aegidae is found in some numbers in the Purbeck Beds (Upper Jurassic), of this country (47). Fossil Isopods have also been recorded from the Oolite and from the Oligocene (Isle of Wight).

Turning to the Woodlice proper, we find that they first make their appearance in the Miocene (of Oenigen and Baden), and occur also in amber (79); while examples of the genera, such as *Oniscus* and *Porcellio*, have been discovered in late Tertiary deposits (47).

External structure and appendages.—Woodlice agree

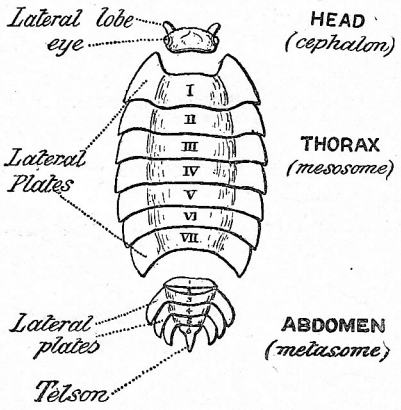


FIG. 1.—PARTS OF THE BODY.
(Oniscus asellus.)

in being of a somewhat oval form, and their bodies are arched, the curve varying in different genera and species. A *head* is to be distinguished; behind this comes the *thorax* of seven segments which are often considerably broader than the six succeeding ones which form the *abdomen* (see fig. 1.)

The head carries two *large antennae* (fig. 3) which are very evident, and a careful search with a lens will reveal a second and minute pair (the *smaller antennae*) situated between the base of the others, and really anterior to them. (figs. 2 and 4.)

FIG. 2.—THE FIRST ANTENNA.
(Oniscus asellus.)

The larger antennae are customarily bent at certain points, and we can distinguish a

terminal part, or *flagellum*, and a basal part, the *peduncle* (fig. 3). The number of joints in these structures, which varies in different genera and species, forms a useful classificatory character, and

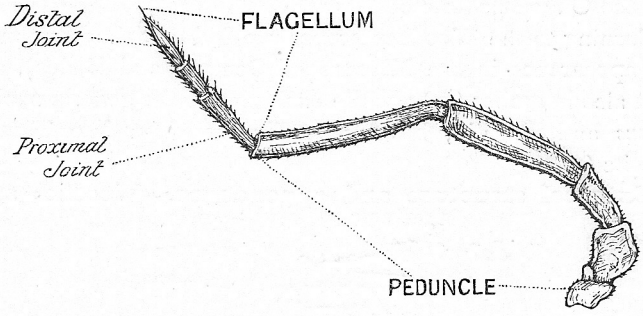


FIG. 3.—THE SECOND ANTENNA.
(*Oniscus asellus.*)

the relative length of the component parts is of considerable value in distinguishing species.

There are four pairs of mouth appendages—namely the jaws

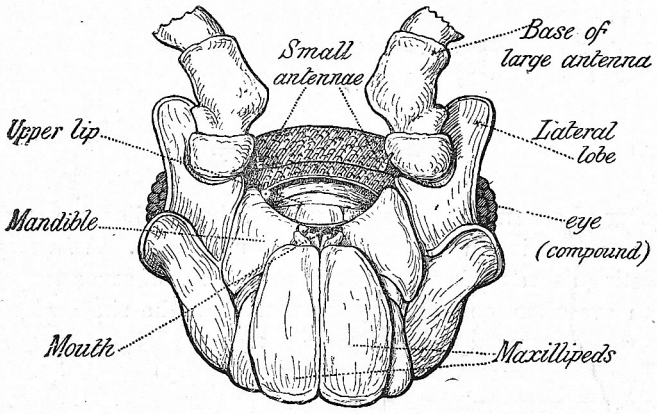


FIG. 4.—THE UNDERSIDE OF THE HEAD.
(*Oniscus asellus.*)

or *mandibles* (fig. 5), the *first maxillae* (fig. 6), the *second maxillae* (fig. 7), and the *maxillipeds* (fig. 8). When the head is examined from the underside the last of these organs will be seen first, covering in the others.

A small median plate attached to the front of the head has been called "*the upper lip*" (fig. 9), while inside the mouth appendages is a little bilobed structure "*the lower lip*" (fig. 10).

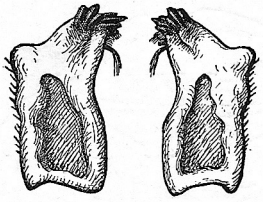


FIG. 5—THE MANDIBLES.
(*Oniscus asellus.*)

Before leaving the external features of the head, we must allude to the pair of *eyes* which are usually present, though never raised on stalks. In the Common Wood-louse (*Oniscus asellus*, from which all our figures to illustrate structure have been made), as in many other species, the eyes are compound (fig. 4), but in some forms these are simple.

Each of the seven joints of the thorax bears a pair of *walking legs* (fig. 11), and in the female at the time when the eggs are laid, a pair of plates (fig. 12) arises on segments II. to V. These plates together

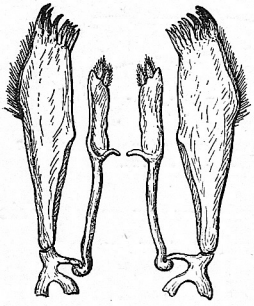


FIG. 6.—THE FIRST MAXILLAE.
(*Oniscus asellus.*)

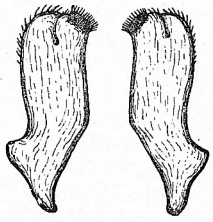


FIG. 7.—THE SECOND MAXILLAE.
(*Oniscus asellus.*)

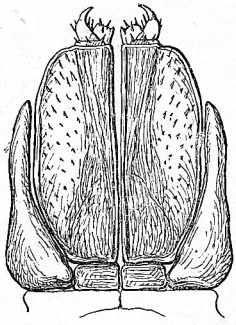


FIG. 8.—THE FUSED MAXILLIPEDS.
(*Oniscus asellus.*)

form a brood pouch, in which the eggs are carried (fig. 12) until they are hatched, and in which the young ones remain for some time afterwards.

When we examine the abdomen, we find that the appendages are plate-like, with the exception of the last pair (fig. 13), and

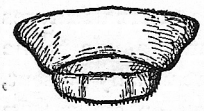


FIG. 9.—THE "UPPER LIP."
(*Oniscus asellus*)

FIG 10.—THE "LOWER LIP."
(*Oniscus asellus.*)

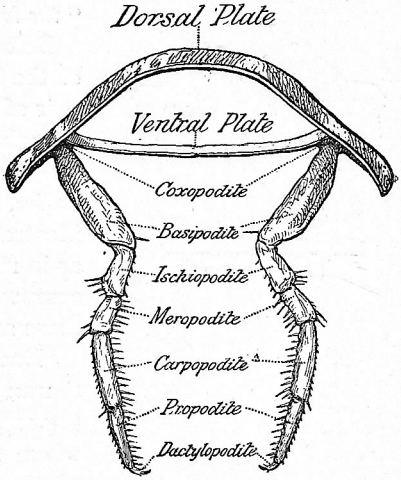


FIG. 11.—A TYPICAL THORACIC SEGMENT
(*Oniscus asellus.*)

they all agree in having two divisions, an arrangement which would prove awkward in limbs used for walking or feeling.

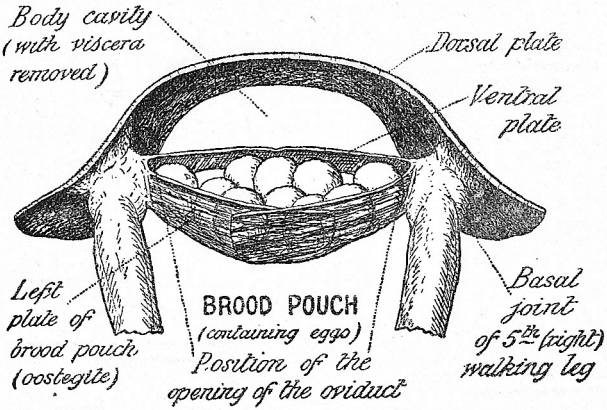


FIG. 12.—THE FIFTH THORACIC SEGMENT OF A FEMALE.
(*Oniscus asellus.*)

The inner plate (or endopodite) is in structure a *gill*, but the blood that passes through it, is enabled to take up oxygen

from moist air, while the outer division (or exopodite) acts as a protecting cover (fig. 14). In *Porcellio*, air-tubes (*tracheae*) may be present (see below).

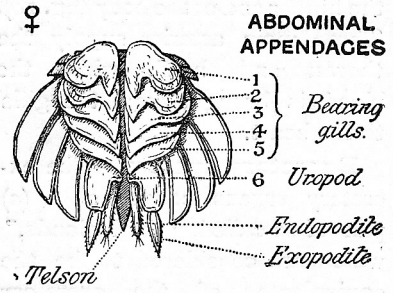


FIG. 13.—THE UNDERSIDE OF THE ABDOMEN OF A FEMALE. (*Oniscus asellus.*)

In the male the first two pairs of abdominal appendages are specially modified, the inner divisions (endopodites) being long and pointed (figs. 15 and 16). The last pair, or tail appendages, in the male are often considerably larger than in the female, and the form of these structures is sometimes of value in classification.

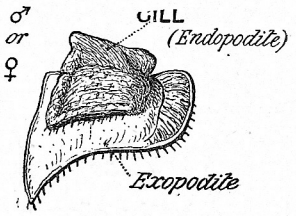


FIG. 14.—A TYPICAL ABDOMINAL APPENDAGE. (*Oniscus asellus.*)

Alimentary canal.—The main portion of the alimentary system is, practically speaking, a straight tube (fig. 17). Its first part (not shown in the figure) is a narrow gullet, which after passing through the nerve collar dilates to form a sort of stomach. Into this the secretion of four digestive glands is poured by two ducts. These glands have a somewhat striking appearance, being yellow tubes spirally

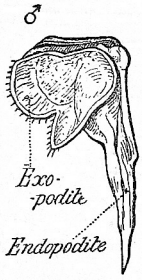


FIG. 15.—THE FIRST ABDOMINAL APPENDAGE OF THE MALE. (*Oniscus asellus.*)

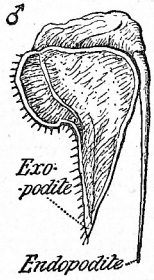


FIG. 16.—THE SECOND ABDOMINAL APPENDAGE OF THE MALE (*Oniscus asellus.*)

coiled, and they end blindly. From the stomach the intestine runs to the hinder end of the body and passes under the heart.

Circulatory system—The blood being aërated in the abdominal appendages, we find that the heart is situated towards the hinder end of the body (fig. 18). Three main arteries supply the thorax and head, while the blood is brought from the gills to the heart.

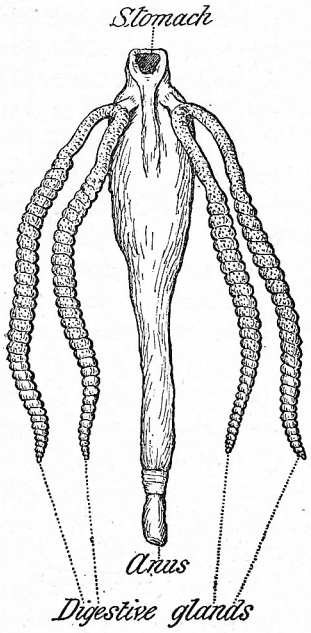


FIG. 17.—THE ALIMENTARY CANAL. (*Oniscus asellus.*)

Excretory system.—The excretory organs consist of a (*a*) pair of so-called "shell glands," which are considered to be the equivalents of the excretory tubes or nephridia of annelid worms. In the woodlouse these excretory organs open on the second pair of maxillae. They are composed of a tube (*sacculus*) closed at one end and more or less bent upon itself (5, p. 261) which communicates with a *labyrinth* that is provided with an excretory orifice. Matters are eliminated by the *epithelial cells* [the histology has been described and figured in *Ligidium hypnorum* (66)], which are very large in *Ligia oceanica*.

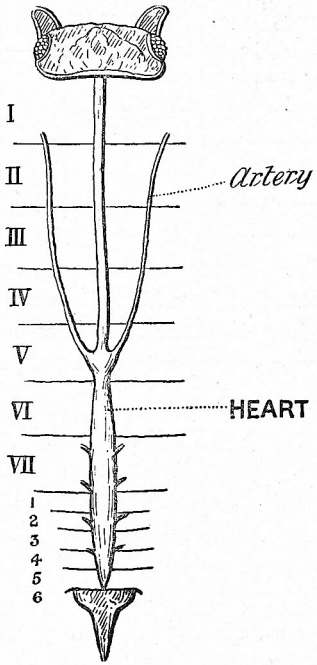


FIG. 18.—THE CIRCULATORY SYSTEM. (*Oniscus asellus.*)

(*b*) Masses of cellules in the head, very greatly developed in *Ligia oceanica* (but numbering scarcely more than ten in *Oniscus asellus*), which have no external opening. They also function as excretory organs (5, p. 263), and have been called "cephalic nephrocytes."

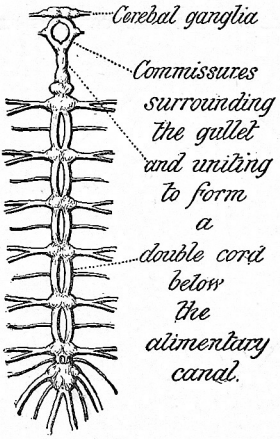


FIG. 19.—THE NERVOUS SYSTEM. (*Oniscus asellus*.)

(*c*) Other "branchial nephrocytes" are situated on the dorsal surface between the last thoracic and the first abdominal segments, as well as between those that follow, with the exception of the last two; they are in distinct patches, one on each of the middle line in *Ligia*, but more or less continuous in *Oniscus* (5, p. 265).

(*d*) The digestive glands have also been shown to be excretory (5, p. 270).

Nervous system.—The nervous system consists of *paired ganglia* in the head, above the alimentary canal which send off nerves (*commissures*) that meet below, to form a *double nerve cord* with ganglia at intervals (see fig. 19).

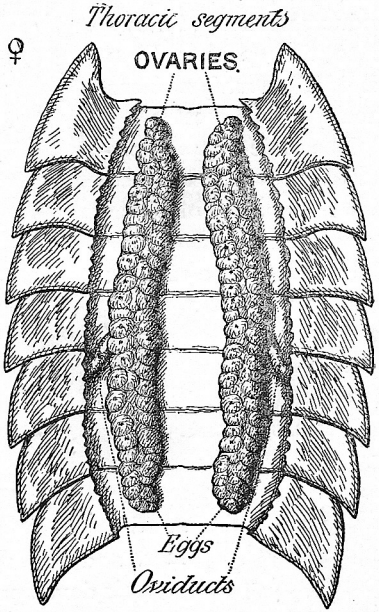


FIG. 20.—FEMALE REPRODUCTORY ORGANS. (*Oniscus asellus*.)

Reproductive organs.—In the female there are a pair of *ovaries* in the positions shewn in fig. 20; and *ducts* run to the underside of the fifth thoracic segment.

The openings are very difficult to identify, and Lereboullet (39, p. 113) was unable to find them. It is obvious that the openings must be underneath the plates that form the egg pouch, and as a change of skin is required to set these free, it would appear that at ordinary seasons the ducts from the ovaries are closed. The writers have been able to determine from external examination of specimens which had moulted and were about to lay eggs, that the oviducts at such time open to the inside of the base of each walking leg on the fifth segment. In similar specimens the oviducts were also followed to the opening from within. The *brood pouch* has already been described.

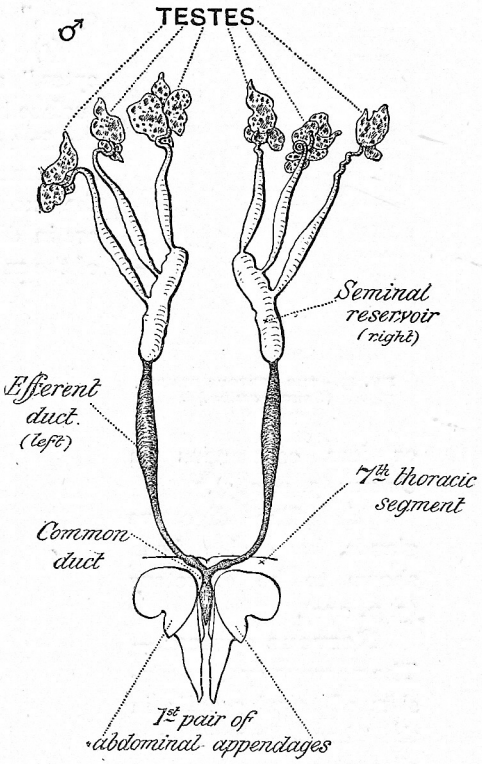


FIG. 21.—THE MALE REPRODUCTORY ORGANS. (*Oniscus asellus.*)

The male organs consist of six *testes* arranged in two pairs, each of which is provided with a *reservoir* (see fig. 21). The efferent ducts from the two reservoirs unite at the base of the thorax to form a common duct (or "penis").

Development.—The eggs, in the common species of woodlice, at least, are laid at the beginning of summer, and are retained in the brood pouch, where they undergo their development. The process has been recently traced with great care by Professor Louis Roule (58) in *Porcellio scaber* and the description which follows is based upon his researches.

As, practically speaking, the larval stages are passed within the egg, and there is no free embryo differing in form from the

parent, it is necessary for the young creatures to be well supplied with nutritive material. In fact, the bulk of the large egg is made up of *food-yolk*, on the outside of which the *formative protoplasm* is disposed in irregular patches. In the fertilized ovum, one of the latter, which lies in a particular position at the end, is found to be larger than the others (see fig. 22). It contains the nucleus of the egg-cell (see fig. 23) and is called the *cicatricula*. This is the only portion of the egg which divides and produces *nucleated cells*. It is these which gradually spread all over the surface of the food-yolk, forming a layer known as the *blastoderm*, which is at first but one cell thick (see figs. 24, 26, and 28).

Before, however, the food-yolk is quite closed in, a differentiation into two layers—the *pro-ectoderm* and *pro-endoderm*—takes place (see fig. 25) and rudiments of the first two pairs of

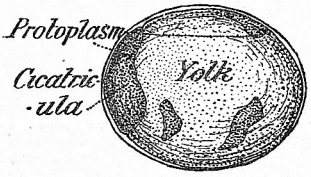


FIG. 22.—THE FERTILIZED EGG (*Porcellio scaber*), AFTER ROULE.

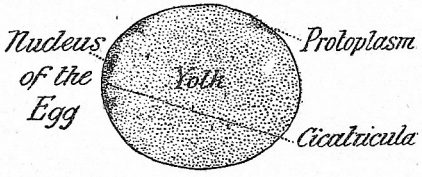


FIG. 23.—THE FERTILIZED EGG SEEN IN SECTION (*Porcellio scaber*), AFTER ROULE.

appendages appear (see fig. 26). Moreover, the cells of the ectoderm change their shape and begin to multiply at two points to form the beginnings of the cerebral ganglia and the nerve cord respectively.

As the blastoderm closes over the food-yolk, two more appendages arise and these are soon followed by others (see fig. 28). A depression appears at the point where the blastoderm closed and internally the pro-endoderm or inner layer is differentiated into two—the *endoderm proper* and the *mesoderm* (see fig. 29). The former begins to grow so that its edges unite to form the middle part of the intestine (see fig. 29) seen from the outside in fig. 30. The depression already mentioned grows deeper, forming a tube which is the hind portion of the *intestine*, while at the anterior end of the embryo the front part of the intestine is similarly formed (see fig. 30). By this time also all the nineteen

SURFACE VIEWS. *OPTICAL SECTIONS.*

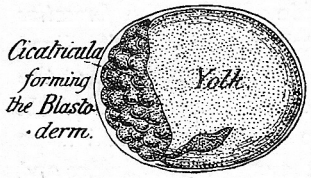


FIG. 24.

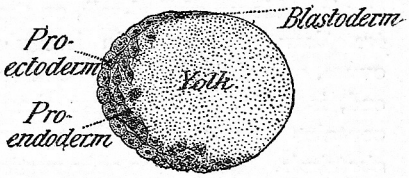


FIG. 25.

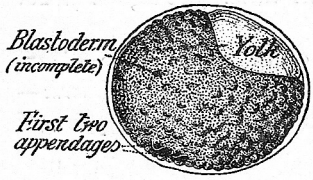


FIG. 26.

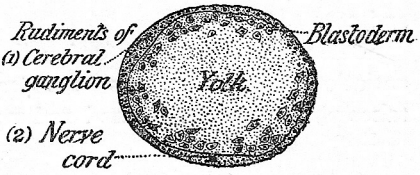


FIG. 27.

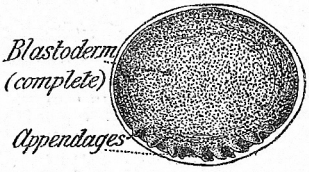


FIG. 28.

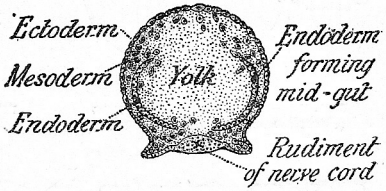


FIG. 29.

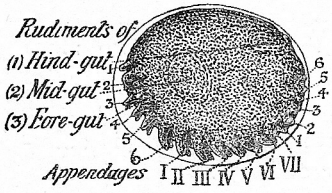


FIG. 30.

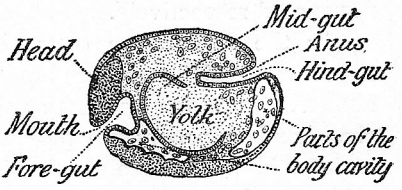


FIG. 31.

THE DEVELOPMENT OF A WOODLOUSE (*Porcellio scaber*), AFTER ROULE.

Figs. 24, 26, 28, 30, are Surface Views, and figs. 25, 27, 29, 31, which indicate slightly later stages respectively than the others, are of eggs seen in Optical Section.

appendages have made their appearance and the mesoderm, (which has grown considerably, to form the beginnings of the muscles) has sent prolongations into each of them. About this time, spaces (see fig. 31) are formed in the muscular mesoderm which are all that remain of the *true body cavity* characteristic of animals above the level of the jelly-fish, and in these spaces the blood ultimately circulates.

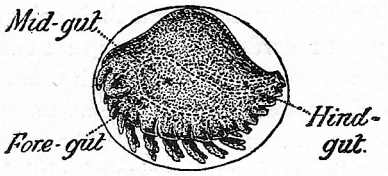


FIG. 32.—EMBRYO OF THE WOODLOUSE SHOWING THE THREE DIVISIONS OF THE INTESTINE SEPARATELY DEVELOPED (*Porcellio scaber*). AFTER ROULE.

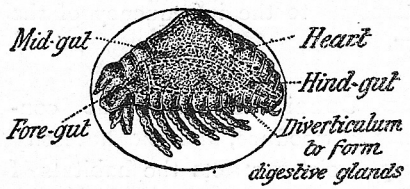


FIG. 33.— EMBRYO OF THE WOODLOUSE SHOWING TRACES OF THE SEGMENTS (*Porcellio scaber*). AFTER ROULE.

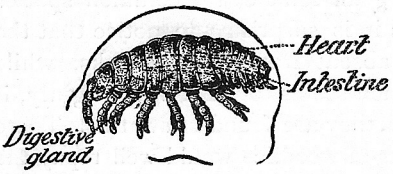


FIG. 34.—AN EMBRYO WOODLOUSE READY TO BE HATCHED (*Porcellio scaber*). AFTER ROULE.

The body next alters somewhat in shape and the three divisions of the intestine approach one another (see fig. 32) previous to their junction. As may be imagined during these processes the food-yolk has gradually been used up and the space which it occupied taken by the internal organs, which we have mentioned.

In the last stages of the development the appendages become larger still, the *heart* makes its appearance, segmentation of the body is completed, and except that the seventh pair of walking legs are as yet rudimentary the woodlouse is completed. It is only after hatching that the pair of legs mentioned, attain to their normal length.

The process of segmentation of the egg and the formation of its layers lasts about a fortnight, while the completion of the development proceeds much more rapidly, for another three weeks bring it to an end.

After the first moult or change of skin the last pair of

walking legs makes its appearance, and Mr. James B. Casserley [whose work one of us (75) has described elsewhere] found when keeping a number of the common pill-woodlouse (*Armadillidium vulgare*) in captivity that his specimens did not subsequently change their skins more than once in the six months during which he had them under observation. He also noted that the crustaceans go on growing after they are sexually mature. As his specimens grew older, Mr. Casserley noticed that their colour became darker, and a curious point recorded by him is that two examples of the same age may change their skins at the same time, and while one may have afterwards nearly twice as many markings, on the other very few at all will be seen. The time required for the growth of a woodlouse from the size of a pin's head to that of an adult example—say three-quarters-of-an-inch long—must be fairly considerable, taking into account the fact that any appreciable increase in size can only occur at a moult and Mr. Casserley's observations as to the infrequency of the process in *Armadillidium vulgare*.

Habits and Economic Considerations.—The construction of the breathing organs of woodlice, and the necessity which exists for these to be kept moist, restricts the habitats of the animals considerably. Woodlice are found under stones and logs, beneath the bark of dead and rotten trees, among decaying vegetable matter as well as living grass and moss in damp or wet situations. When looking for some of the common species under the bark of fallen trees it is surprising to notice that the crustaceans may be entirely absent from many trunks, while when another is examined which seems to differ very slightly, if at all, in condition or situation, they are found in swarms. There is no doubt but that the habits of woodlice would well repay the attention of naturalists, who are now recognizing that besides anatomy as such, and the classification which a knowledge of structure permits, there is the equally important consideration of the creatures as they live their own life and affect that of others. It is not our object to give a detailed account of the ecology of British woodlice, but rather to provide a basis from which it may be approached. Nevertheless a few general remarks may not come amiss. Many points in the life-history of woodlice may no doubt be learned by keeping them in captivity and there is

just sufficient difficulty in doing this successfully to give an interest to the matter.

Apart from a supply of proper food, we take it that the chief object to be attained is the provision of the amount of moisture required by the particular species under examination, together with a sufficient supply of air.

A great many interesting observations can be thus carried out, such as those of Mr. Casserley, to which allusion has already been made. The process of moulting for instance is well worth watching, and although specimens with half their coat changed may be found in remote corners, yet the whole course of the moult can be seen much better in the case of captive woodlice. The following account is taken from Mr. Casserley's description (75) of what happens in the case of *Armadillidium vulgare*:—The approach of the moult is indicated by the appearance of a white border on each segment of the body, which becomes gradually more marked, while at the same time the animal is seen to be less active and often makes a small burrow in which to hide. Sometimes a sheltered corner against a stone is looked upon as affording sufficient protection, but in either case each woodlouse keeps to the place originally chosen. About ten days after the white lines have become visible the animal appears to be divided into two. Its skin is becoming loose and little movement can take place at the joints of its body with the exception of that between the fourth and fifth thoracic segments where the skin will ultimately break. The woodlouse spends a day or two in this condition and then, by suddenly walking forward, frees itself from the covering of the hinder portion of its body The three last pairs of walking legs are carefully pulled out from the old skin, which now appears perfectly white, and at the same time the lining of the hind portion of the alimentary canal (hind gut) is also shed. After putting the tender half of his body well into his corner or burrow the woodlouse proceeds to eat the part of his skin that he has cast. The creature has now a very odd appearance. His front half with the exception of the white edges is as it was before, the rest of him instead of a light slaty blue, and is very soft as well as proportionately a little larger.

In three days or so the tail end becomes hard and attains the normal colour. Then the old skin from the front half is pushed off and the creature becomes practically defenceless, so much

so in fact, that any of his species that happen to find him will attack him and eat all his front half, rejecting, however, his now hardened tail-end.

Provided that the moulting woodlouse has survived (and in captivity, to ensure this, he must be isolated), after three days his jaws will be sufficiently hardened to allow of his eating, and usually he first of all devours the second half of his cast skin. The operation of moulting does not occupy quite so long a time in the case of young examples. Specimens half-an-inch long do not moult more than once in six months and show but little increase in size after the process.

Woodlice do not appear to live on either animal or vegetable food alone, but adopt a mixed diet. It is, however, owing to their attacks upon cultivated plants that the creatures are looked upon as pests by the horticulturalist. The animals feed either in the night or in the very early morning, on seedlings, orchid tubers, mushrooms, or anything that comes to hand. Few of the accounts, however, of their ravages, mention that the crustaceans have been caught absolutely in the act of doing the damage ascribed to them. Some careful inquiries have nevertheless enabled us to discover several observers who have watched woodlice feeding. Mr. F. V. Theobald, of Wye College, and one of the students at Swanley Horticultural College are among the number. The former has also given us an account of the methods, out of many tried, which he has found most successful for getting rid of the crustaceans. Out of doors trapping with moss, sacking or horse-dung is best. In glass houses, fumigation with hydro-cyanic acid gas has cleared them out, and poison baits, especially potatoes cut and soaked in white arsenic, have done some good. Stable manure is especially favourable to these creatures, particularly when it is used "long": in this condition it should therefore be avoided.

It is interesting to note how the woodlice in winter simply remain where they happen to be so long as there is sufficient moisture, though they are ready to run about as rapidly for a time as in summer, should they happen to be disturbed.

No doubt many points of inter-relation between woodlice and other animals remain to be discovered. Mr. John W. Odell tells us that on Exmoor, in the open, he found no *Armadillidia*, though other forms occurred under nine out of every ten stones

that he turned over, and here the smaller species of ants also abounded. Close to stone walls *Armadillidia* were to be seen to the exclusion of all other genera, and this state of affairs was ascribed by Mr. Odell to the presence of swarms of the large wood-ants which he considers would make short work of any woodlice that could not protect themselves by rolling up.

We ought not to conclude this account without mentioning the fact that woodlice once played an important part in medicine.

Doctor Fernie (28) gives some interesting extracts with regard to the hoglouse and the woodlouse. The latter he seems to have identified quite correctly as *Oniscus asellus*. He calls the former, however, indiscriminately, "the common armadillo" (which is the old name for the pill-woodlice now known as *Armadillidium*), "the pill millipede" and "*Glomeris marginata*." The last two names are those of another creature, not a crustacean, which when it is rolled up can be very easily mistaken for an *Armadillidium*, though, when it uncurls, it will be seen to have many more than seven pairs of legs. The local appellations applied to the hog-louse by Doctor Fernie, and his remarks with regard to its commonness, tend to show that it is *Armadillidium vulgare*, to which he really refers, and the use of which in medicine was commonly general.

Hog-lice were prescribed for scrofulous diseases and obstructions of the liver and digestive organs, among other things, and the London College of Physicians directed that the creatures should be prepared by suspending them in a thin canvas bag placed within a covered vessel over the steam of hot spirit or wine, so that being killed by the spirit they might become friable. Hog-lice and Wood-lice were also administered alive, while the former were also put down the throats of cows "to promote the restoration" of their cud, hence their name of "cud-worm." There seems to be considerable evidence that even in modern times Wood-lice have had considerable remedial effect which depends upon an alkalescent fluid contained in them.

Local Names.—Among the local names by which these creatures are known are those of "sow bug," "lucre pig" (Berkshire), "carpenter" and "chiselhog" (Berkshire). Doctor Fernie (28) gives a number of others:—"thrush-louse," "tiggyhog," "cheslip," "kitchenball," "chiselbob," "lugdor,"

'palmer," and "cudworm." In the eastern counties the same writer notes that they are known as "old-sows" or "St. Anthony's hogs" while the Welsh call them "little grey-hogs," "the little old women of the wood" or "grammar-sows," grammar signifying a shrivelled up old dame. *Oniscus asellus* was sometimes called "socchetre," "church louse," and "chinch."

Methods of Collection and Preservation.—Woodlice should be collected straightway into tubes or bottles half filled with 30 per cent. methylated spirit.[3] Woodlice dropped into this weak spirit become gradually narcotised and die, and they remain limp enough for purposes of examination or to allow, of their legs and antennæ being set out during the process of mounting. Specimens to be kept permanently should be placed in 70 per cent. alcohol. For storage purposes the specimens of each species from a given locality should be put together into a small flat bottomed tube such as are used for pillules by apothecaries or specially made for natural history purposes. A paper label on which the name, locality, date of capture and any other necessary particulars have been written with dark lead pencil, is not affected by the spirit. The tubes may be corked, though if not frequently examined all the spirit may evaporate, and cause the specimens to be spoilt. A safer method is to plug the tubes with cotton wool and keep all those containing a given species or specimens from a particular locality beneath the surface of spirit in a large wide-mouthed bottle, into which first of all some cotton wool has been put to prevent the tubes from coming into sudden contact with the glass at the bottom. For show purposes in museums, specimens taken direct from 30 per cent. spirit should be mounted on slips of opal glass by means of gum-tragacanth which has been powdered and shaken up in spirit before having water added to it. The slips can be exhibited in glass tubes, six inches high by one across, or in narrow stoppered museum jars. A variation of the method is to mount the animals on clear glass and to place behind them another strip of any colour that may be preferred.

3 It should be pointed out that the methylated spirit now sold in the shops contains mineral naptha and goes milky on the addition of water. Permission can be obtained from Somerset House to buy what is still called "ordinary methylated spirit," but at present five gallons has to be purchased at one time.

Classification.—The various genera of woodlice are connected together so closely, by intermediate forms, that their division into families is to a very great extent, arbitrary. Bate and Westwood described but a single family Oniscidæ (1), though they distinguished two sub-families :—Ligiinæ, which included the forms with many joints to the flagellum of the antenna, and Oniscinæ, which contained the rest.

Since then the pill-woodlice have been thought by some, to be sufficiently different from the other genera to warrant their separation, and three families namely, Ligiidæ, Oniscidæ, and Armadillidæ have been recognized, as for instance by Dr. Scharff (63).

A fourth family—Trichoniscidæ—has been added by Professor G. O. Sars, who in his *Crustacea of Norway* (59) alludes to the division of the tribe into the sections Ligiæ and Onisci and has adopted the following classification :—

Order—ISOPODA.

Tribe—ONISCOIDA.

Family I.—LIGIIDAE.
Ligia.
Ligidium.

Family II.—TRICHONISCIDÆ.
Trichoniscus.
Trichoniscoides.
Haplophthalmus.

Family III.—ONISCIDÆ.
Oniscus.
Philoscia.
Platyarthrus.
Porcellio.
Metoponorthus.
Cylisticus

Family IV.—ARMADILLIDIIÆ.
Armadillidium.

All the genera described by Professor Sars are represented in the British Islands.

Below is a scheme of classification and synopsis of the characters of British genera of woodlice which we have compiled in order to render easy the determination of the genus to which any particular specimen may belong.

SCHEME OF CLASSIFICATION AND SYNOPSIS OF GENERIC CHARACTERS.

Order—ISOPODA.

Tribe—ONISCOIDA.

Section I.—LIGIÆ.

The Two Divisions of the Tail Appendages alike in Shape.

(A.)—Flagellum with 10 or more joints; tail appendages wholly visible; head without lateral lobes - LIGIIDAE.

(1.)—Abdomen broad; body large; habitat the sea-shore - - - - *Ligia.*

(2—Abdomen narrow; habitat wet moss - *Ligidium.*

(B.)—Flagellum with less than 10 joints; head with small lateral lobes, tail appendages partly covered TRICHONISCIDÆ.

(3.)—Abdomen narrow; eyes compound; flagellum usually with more than 3 joints - - - - *Trichoniscus.*

(4.)—Abdomen narrow; eyes simple or wanting; flagellum with 4 joints - - *Trichoniscoides.*

(5.)—Abdomen broad (comparatively); eyes simple; back with longitudinal; ridges; flagellum with 3 joints - *Haplophthalmus.*

Section II.—ONISCI.

The Outer Divisions of the Tail Appendages Broader than the Inner.

(A.)—Tail appendages projecting when the animal is walking - - - - - - ONISCIDÆ.

(a.)—Unable to roll up into a complete ball.

(6.)—Flagellum with 3 joints; abdomen broad; head, with lateral lobes - *Oniscus.*

(7.)—Flagellum with 3 joints; abdomen narrow; head without lateral lobes - *Philoscia.*

(8.)—Flagellum with 1 joint; eyes wanting; abdomen broad; habitat, ant's nests *Platyarthrus.*

(9.)—Flagellum with 2 joints; abdomen broad; frontal lobe projecting - *Porcellio.*

(10.)—Flagellum with 2 joints; abdomen narrow - - - - *Metoponorthus.*

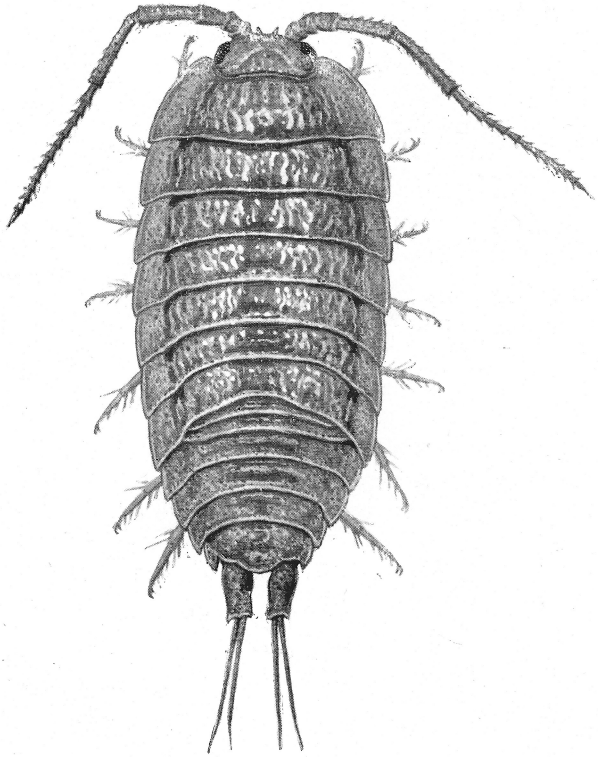
(b.)—Able to roll up into a complete ball.

(11.)—Flagellum with 2 joints; antennae folded together over the thorax when the animal is rolled up into a ball - *Cylisticus.*

(B.)—Tail appendages not projecting when the animal walking - - - - - ARMADILLIDIIDÆ.

(12.)—Flagellum with 2 joints; antennae hidden or carried at the sides of the head when the animal is rolled up into a ball - - - - *Armadillidium.*

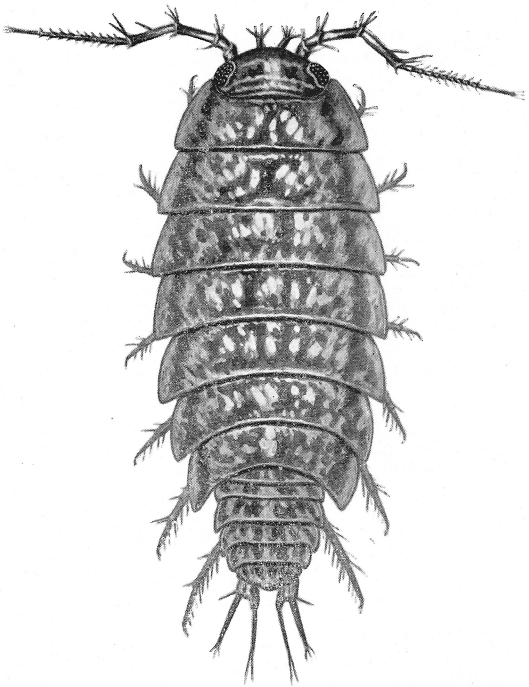
[*To be continued.*]



LIGIA OCEANICA Linné. THE QUAY-LOUSE.

Length, two to three centimetres.

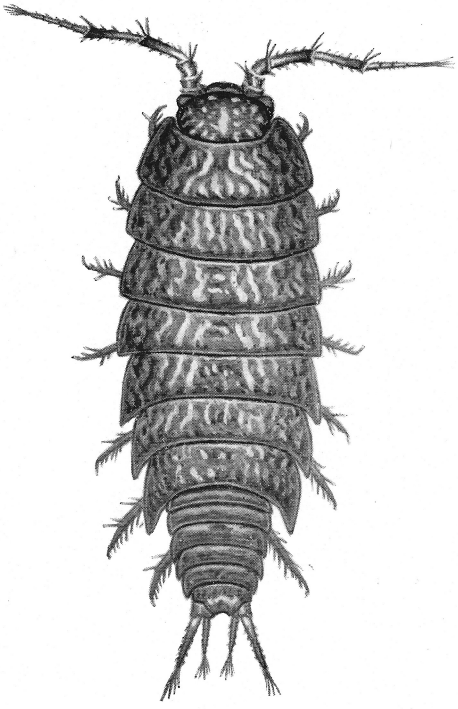
Charles Sillem, del. ad nat. F. W. Reader, sculpt



LIGIDIUM HYPNORUM Cuvier.

Length, nine millimetres.

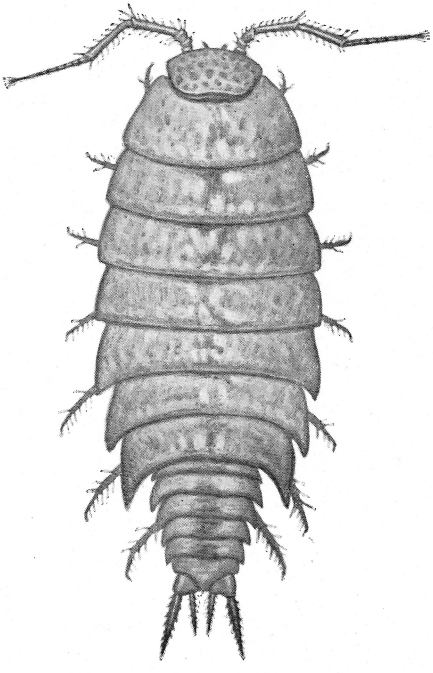
Charles Sillem, del. ad nat. F. W. Reader, sculpt.



TRICHONISCUS PUSILLUS Brandt.

Length, four millimetres.

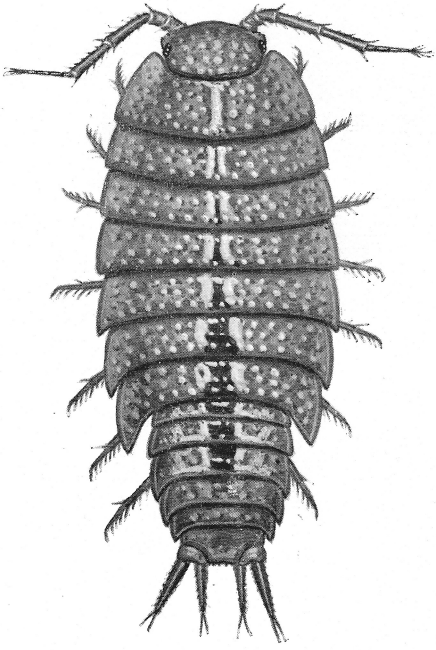
Charles Sillem, del. ad nat. F. W. Reader, sculpt.



TRICHONISCUS VIVIDUS Koch.

Length, eight millimetres.

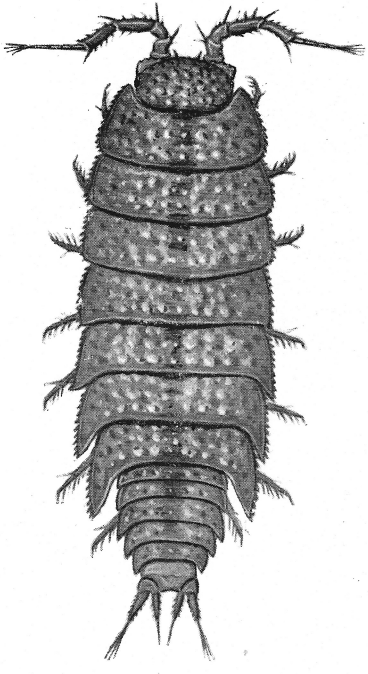
Charles Sillem, del. ad nat. F. W. Reader, sculpt.



TRICHONISCUS ROSEUS Koch.

Length, five millimetres.

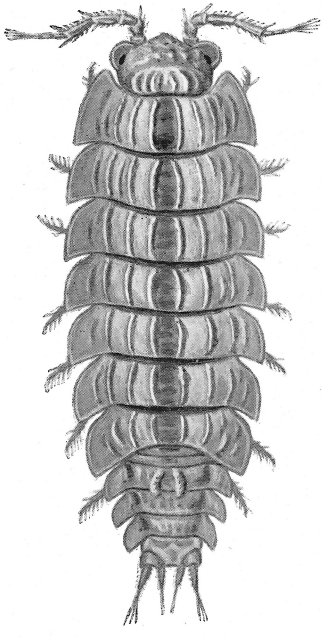
Charles Sillem, del. ad nat. F. W. Reader, sculpt.



TRICHONISCOIDES ALBIDUS Budde-Lund.

Length, four millimetres.

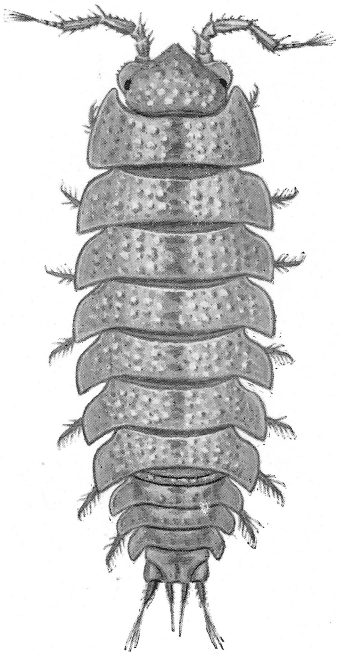
Charles Sillem, del. ad nat. F. W. Reader, sculpt.



HAPLOPHTHALMUS MENGII Zaddach.

Length, three to four millimetres.

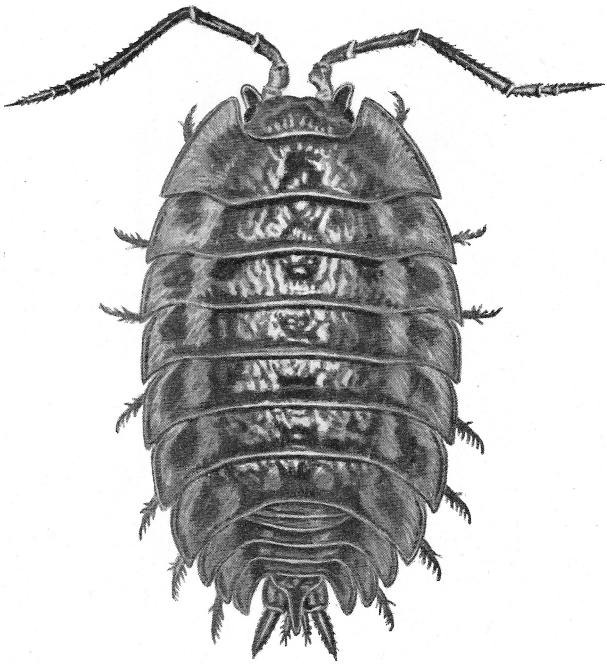
Charles Sillem, del. ad nat. F. W. Reader, sculpt.



HAPLOPHTHALMUS DANICUS Budde-Lund.

Length, three to four millimetres.

Charles Sillem, del. ad nat. F. W. Reader, sculpt.



ONISCUS ASELLUS Linné (The common slater).

Length, sixteen millimetres.

Charles Sillem, del. ad nat. F. W. Reader, sculpt.

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